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THE LONDON NATURALIST

Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 80 2001

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LONDC Y SOCIETY

The Society welcomes new members, both beginners and experts. Its recording area (the London Area) lies within a 20-mile (32-km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society comprises Sections whose meetings are open to all members without formality. For those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology, or rambling, there is a Section ready to help.

Publications

The London Naturalist, published annually, contains papers on the natural history and archaeology of the London Area and beyond, including records of plants and animals.

The *London Bird Report,* also published annually, contains the bird records for the London Area for each year, as well as papers on various aspects of ornithology.

Bulletins of news items, including the Society's *Newsletter* and the *Ornithological Bulletin,* are sent to members throughout the year.

Indoor meetings

These are held in most weeks throughout the year, with lectures, discussions, colour slides and films on all aspects of natural history.

Field meetings

Led by experts to visit interesting localities, both within and outside our Area. These excursions are very popular with beginners wishing to increase their knowledge, and enable members to get to know one another.

Library

A large selection of books and journals on most aspects of natural history is available for loan or consultation by members free of charge.

Reading circles

Many important natural history journals are circulated by the Sections at a fraction of the cost of subscribing direct.

SUBSCRIPTIONS

ORDINARY MEMBERS	£15.00
JUNIOR MEMBERS	£5.00
SENIOR MEMBERS	£8.00
FAMILY MEMBERS	£3.00
CORPORATE SUBSCRIBERS	£15.00

Junior membership is for persons under 18, or under 25 and receiving full-time education, and senior membership is for persons over 65 who have been continuous members of the Society for ten complete years. All except family members receive one free copy of *The London Naturalist* and the *London Bird Report* each year. Cheques and postal orders, payable to the London Natural History Society, should be addressed to:

The Membership Secretary, LNHS,
Ruth Day, 18 Zenoria Street,
London SE22 8HP

THE LONDON NATURALIST

Further copies of this issue of *The London Naturalist* may be obtained (price £6 plus £1 postage and packing in the UK and the Republic of Ireland) from Catherine Schmitt, 4 Falkland Avenue, London N3 1QR. Back numbers of most recent issues of both *The London Naturalist* and *London Bird Report* are also available from the same address. Cheques should be made payable to the London Natural History Society.

Top: Maude-fields, Harefield, Middlesex. First recorded location of *Fritillaria meleagris* as a wild plant in Britain in 1736. Bayhurst Wood is on the right, and Mad Bess Wood behind Warren Farmhouse.

Bottom: *Fritillaria meleagris* growing in deep shade in the grounds, derelict for sixty years, of High Grove House, Eastcote, about two miles from Maude-fields.

Photos: Colin Bowlt

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THE LONDON NATURALIST

Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 80

for the year 2000

Edited by K. H. Hyatt

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LONDON NATURAL HISTORY SOCIETY

Founded 1858

President

David McClintock, MA, FLS
Bracken Hill, Platt, Sevenoaks, Kent TN15 8JH

Honorary Vice-Presidents

†E. B. Bangerter, FLS, A. J. Barrett, Miss E. P. Brown, R. M. Burton, MA, FLS, R. E. Butler, B.SC., FGS, R. S. R. Fitter, FLS, FZS, MBOU, R. W. Hale, P. C. Holland, K. H. Hyatt, FLS, E. M. Nicholson, CB, CVO, LL D, MBOU, R. M. Payne, FRES, FLS, R. A. Softly.

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Secretary: A. J. Barrett, 21 Green Way, Frinton-on-Sea, Essex CO13 9AL.

Treasurer: M. J. West, 52 Trinity Road, Ware, Hertfordshire SG12 7DD.

Membership Secretary: Ms R. Day, 18 Zenoria Street, London SE22 8HP.

Librarian: Mrs L. Hewitt, 106 Hatherley Court, London W2 5RF.

Archivist: Dr P. F. S. Cornelius, 51 Green Court Road, Crockenhill, Swanley, Kent BR8 8HF.

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Editor, *London Bird Report:* A. Self, 16 Harp Island Close, London NW10 0DF.

Editor, *Newsletter:* A. J. Leppard, 63 Rydal Gardens, Hounslow, Middlesex TW3 2JJ.

Editor, *Ornithological Bulletin:* N. Tanner, 11 Collins House, Newby Place, London E14 0AX.

Elected Members of Council: N. Anderson, M. Burgess, Ms A. Chipchase, Dr J. F. Hewlett, A. J. Leppard, Miss F. J. Turtle.

Representative Members of Council: Bookham Common Survey — Dr I. S. Menzies; Botany — R. A. Blades; Ecology and Entomology — Mrs C. M. Schmitt; Hampstead Heath Survey — Dr C. Bowlt; Ornithology — Miss N. A. Duckworth.

---

† Deceased May 2001.

The Society's Recorders

Botany

Flowering plants and vascular cryptogams: R. M. Burton, MA, FLS, Sparepenny Cottage, Sparepenny Lane, Eynsford, Kent DA4 0JJ (01322 863216).

Lichens: Ms A. J. H. Waterfield, B.SC., 29 Gloucester Crescent, London NW1 7DL (020-7267 8060).

Ecology and Entomology

Mammals: C. Herbert, 67a Ridgeway Avenue, East Barnet, Hertfordshire EN4 8TL (020-8440 6314).

Reptiles and amphibians: T. E. S. Langton, B.SC., 12 Millfield Lane, London N6 6RA (01986 784518).

Fishes: Dr Ruth Kirk, School of Life Sciences, Kingston University, Kingston upon Thames, Surrey KT1 2EE (020-8401 6766).

Arachnida: J. E. D. Milner, B.SC., 80 Weston Park, London N8 9TB (020-8341 2158).

Coleoptera (Carabidae and Coccinellidae): P. R. Mabbott, B.SC., 49 Endowood Road, Sheffield S7 2LY (0114-201 4504).

Coleoptera (Lucanidae and Buprestidae): Dr D. S. Hackett, FRES, 3 Bryanstone Road, London N8 8TN (020-8292 6134).

Coleoptera (families not otherwise listed): M. Barclay, 47 Tynemouth Street, London SW6 2QS (020-7371 9095).

Lepidoptera (butterflies): L. R. Williams, 34 Christchurch Avenue, Kenton, Harrow, Middlesex HA3 8NJ (020-8907 4428).

Lepidoptera (moths), Syrphidae, and invertebrates not otherwise listed: C. W. Plant, B.SC., FRES, 14 West Road, Bishops Stortford, Hertfordshire CM23 3QP (01279 507697).

Orthoptera: Miss S. L. Bain, 232 Brecknock Road, London N19 5BQ (020-7609 0430).

Hymenoptera Aculeata: R. W. J. Uffen, 4 Mardley Avenue, Welwyn, Hertfordshire AL6 0UD (01438 714968).

Heteroptera: Vacant.

Odonata: Ms Ruth Day, B.SC., 18 Zenoria Street, London SE22 8HP (020-8693 4259).

Plant galls, Isopoda and Myriapoda: K. Hill, BA, FLS, 93 Elmhurst Drive, Hornchurch, Essex RM11 1NZ (01708 456652).

Mollusca: Vacant.

Records may be sent to the appropriate recorder (where shown) or to Colin Plant who will distribute to each recorder the relevant data from a mixed set of records.

Geology

c/o R. E. Butler, B.SC., FGS, 205 Barnett Wood Lane, Ashtead, Surrey KT21 2DF (01372 274103).

Ornithology

Inner London: D. McKenzie, 26 Cuthbert House, Hall Place, London W2 1LT.

Hertfordshire: A. D. D. Wilson, 7 Douglas House, Davison Drive, Cheshunt, Hertfordshire EN8 0SZ.

Buckinghamshire: A. V. Moon, 46 Highfield Way, Rickmansworth, Hertfordshire WD3 2PR.

Kent and Lower Thames (London Bridge to Tilbury): D. Miller, 65 Whitemill Road, Crayford, Kent DA1 4AB.

Surrey and Upper Thames (Wandsworth to Staines): S. J. Spooner, 32 Berkeley Drive, West Molesey, Surrey KT8 1RA.

Middlesex: S. Connor, 21 Salisbury Road, Enfield Lock, Enfield, Middlesex EN3 6HG.

Essex: S. R. Harris, 155 Downsell Road, London E15 2BS.

Requests for information should be made to the appropriate recorder.

Contents

Fritillaria meleagris in Middlesex . . . . *Frontispiece*

Officers for 2001 3

The Society's Recorders 4

Report of the Society for the year ending 30 June 2000 6

Official and sectional reports for 2000 12

FITTER, RICHARD — The wildlife of the London Area in 2100. Crocodiles or polar bears? 15

WILTSHIRE, ELINOR and COOMBES, ALLEN J. — *Quercus* × *turneri* Willd. — a rare London hybrid oak 21

KENT, DOUGLAS H. — The history of *Fritillaria meleagris* in Britain to 1900 . . 29

BURTON, JOHN F. — A history of the vertebrate fauna of Blackheath and Greenwich Park, 1850–1999 43

MUIR, A. I. — Strandings of Royal Fish (Mammalia: Cetacea) in Greater London 99

REEVE, N. J., PALMER, I., JONES, K. E., BLANC, J. and FURE, A. — Trapping surveys of small mammals on Wimbledon Common, Bushy Park and Ham Lands, south-west London 109

WHEELER, ALWYNE — Restoring salmon *Salmo salar* to the River Thames; the work of the Thames Salmon Trust 127

DENNIS, M. K. — The birds of the Inner Thames — an avian highway . . 131

TITTLEY, IAN — Changes in the marine algal flora of the tidal Thames: a millennium review 135

MABBOTT, PAUL — Report of the second London ladybird survey, 1999–2000 147

SHAW, P. J. A. and BUCKHOREE, Z. — Collembola (springtails) of Brockham lime kilns, Box Hill 159

MILNER, J. EDWARD — Spider records for London and Middlesex counties in 2000 167

WILLIAMS, L. R. — London butterfly monitoring report for 2000 169

Survey of Bookham Common: fifty-ninth year
Progress report for 2000 181

BAXTER, ROGER and BAXTER, ELSPETH C. — Results of a five-year study of leaf miners (Diptera: Agromyzidae) on Bookham Common 193

Hampstead Heath Survey. Progress report for 2000 203

BURTON, RODNEY M. — Botanical records for 2000 219

Obituary: VICTOR FREDERICK HANCOCK, MBOU, 1915–2000 225

Book reviews index 231

Report of the Society for the year ending 30 June 2000

Approved at the Annual General Meeting on 6 December 2000

The highlight of the past year was the publication of the first papers following our survey of Buckingham Palace Garden. We are grateful both to the original workers, and to Colin Plant for undertaking the preparation and editing of the results. The papers were issued as a Supplement to *The London Naturalist* No. 78 and were well reviewed by the national press including *The Times, The Independent* and *The Daily Telegraph* and more locally in the *Evening Standard.* It is planned that the second Supplement will be issued with *The London Naturalist* No. 80 in 2001.

In May 2000 your Council approved a donation of £20,000 to The Wildfowl and Wetlands Trust's Wetland Centre at Barn Elms Reservoirs; this is by far the largest donation ever made by the Society: the money has been used in the Pond-dipping area and a plaque has been erected detailing our sponsorship. Many members were present at the opening of the project which will do much to enhance the work and study of natural history in our area. The Society will continue to receive records from the Centre.

In June 2000 Max Nicholson was awarded the Stamford Raffles medal of the Zoological Society of London for a lifetime of distinguished work.

Membership

We regret that we must record the deaths of Christa Frake, Maurine Gibbs-Fricker, Vic Hancock (a past President of the Society, Treasurer for ten years and who in addition had held many offices in the Society), Margaret Kennedy (an Honorary Vice-President and one who had given countless hours of her time to the Society), Prof. J. Landells (a member since 1946), Olive Maunder (a member since 1952) and Ronald Peal. At the time of their deaths both Margaret and Vic were Trustees of the Society: orbituaries for them both will appear in *The London Naturalist* No. 79. It is always sad to record the deaths of long-standing members, but whilst not belittling previous losses this past year has seen the Society suffer severe losses in both wisdom and support.

After nearly twenty years as your Membership Secretary Peter Holland has relinquished his role (Ruth Day has taken over). It is almost impossible to thank Peter enough for the great work he has done.

As at 30 June 2000 the paid up membership stood at 1,131 made up as follows:

Ordinary	829	Junior	9	Honorary	26
Family	86	Senior	143		
Corporate	34	Life	4		

At the Annual General Meeting in December last our President Richard Fitter talked about the Society in the 1930s and 1940s to an enthusiastic audience.

Publications and journals

The London Naturalist No. 78 was published in December 1999 and was well received by the scientific community. Our programmes remain both popular and varied. *London Bird Report* No. 63 for 1998 as yet remains unpublished as does the proposed *Atlas* of London's Birds. Work on the history of the Society is progressing although it is not intended to publish this for some years.

Copies of our previously published books continue to be donated to suitable libraries throughout the country.

Research stations

Hampstead Heath Survey. The regular monthly surveys have continued with about thirty members involved although the Public Open Day in June was again largely washed away by heavy rain. The botanists have started work on detailed distribution maps of the plants of the Heath which it is hoped will form the basis of a new Hampstead Heath *Flora* to replace the 1986 GLC booklet; the Corporation of London has already agreed to publish the work. We have at last extended our studies to the pond life of the Heath.

Bookham Common. A year of solid research work was led by Ian Menzies with major projects in entomology and botany: both will produce substantial papers for *The London Naturalist.*

Sections

Botany. Tribute must be paid here to Rodney Burton who has relinquished the chair of the Section after thirty years. He has been a tower of strength both in the Section and in the Society generally. He remains a member of the committee of the Section and continues to serve on the Council of the Society.

Ecology and Entomology. The Section again organized our participation at the Annual Exhibition of the Amateur Entomologists' Society.

Ramblers, Archaeology and Geology. Regretably this Section has now been wound up, it proving impossible to run the Section on a viable basis; it is however hoped to slot the Geology element into the Ecology and Entomology Section. It is unlikely that a viable General Section could be created at present. Our thanks go to all those volunteers who kept the Section alive for so long in the face of mounting apathy.

Ornithology. The highlight of the period was a symposium on Wimbledon Common organized by Ron Kettle. The Section seems to be suffering more than most in obtaining volunteers to carry out essential functions — the debt to those presently working for the Section is consequently all the greater.

Archives

The largest addition to the archives this year was a variety of material from the late Brad Ashby and, with it, a smaller amount originating from the late Dr Geoffrey Beven. Included was much historical material relating to the Bookham Survey, in which both played leading roles, the newsletter *The London Atalanta* (now sadly defunct) which Brad produced for several years, and the Society's Ornithology and Ecology & Entomology Sections, In addition some more general material appropriate for the Society's main archives was given. Several rare, local natural history items will be valuable additions to the Society's library. The Sections have been contacted concerning any relevant material.

Library

We must immediately record our thanks to Mrs Czigány who has now retired from her work at Imperial College. She has been a good friend to our Society and all members will wish her well. To this we should add our thanks to all the staff at the College.

In all 105 books and reports have been added to the library during the past year, including several older ones missed in the past. Libraries of identification guides are also being built up at Bookham Common and Hampstead Heath. Some gaps in journal runs have been filled mostly by donations from members responding to appeals in the *Newsletter*.

Space on the open shelves has become a problem and books and journals dealing with other countries have been removed to an empty office kindly lent by the Life Sciences Librarian. Disposal may become necessary in future, as libraries from other faculties and medical schools are moved onto the Imperial College campus.

Your Society is committed to improving the quality of our library but the absence of a complete catalogue coupled with a lack of enthusiasm from members means that progress is necessarily slow. The library Committee is continuing to work on these issues but as ever the time which our helpers can offer is never enough.

Conservation

Our Conservation Team has continued to comment on behalf of the Society on a tide of planning applications from the London boroughs — a task which is probably more necessary than ever in view of the political pressure to increase the amount of building in London. Much of this pressure is now falling on areas of previously developed land, which the government calls brownfield sites. Many such sites have developed into diverse habitats of considerable nature conservation importance and a Wastelands Forum has been set up to defend the best of them and to counter threats to their survival. The Conservation Officer and Secretary are both active members of the Forum.

The resurveying of Beverley Brook has been completed. Results will be published in *The London Naturalist* and a full report lodged in the Society's library.

Now, however, members of this Working Group are involved in activities which no longer fit tidily into the old catagories. An important landmark for nature conservation in London was reached in January when the London Biodiversity Partnership (the Society is a member) held a conference to launch the first phase of its action plan, the Biodiversity Audit. This foundation document describes the major habitats and species present in the capital, the threats to them and the opportunities for their conservation. It will form the basis of the unfolding Biodiversity Action Plan which will have strong links with the Mayor of London's Biodiversity Strategy. Meanwhile, individual boroughs and neighbouring counties around London have been developing their own Local Biodiversity Action Plans. This welcome activity means that biological recording has become a major conservation issue.

The National Biodiversity Network now has formal existence as a company limited by guarantee with charitable status. Membership will be largely confined to nominees of organizations and the Society will need to decide in due course whether to apply for associate membership, the catagory appropriate to natural history societies. In the meanwhile, work has just started within the London Biodiversity Partnership on defining and agreeing standards for site definition as a first step towards full agreement of recording standards among all partners working in the same area.

Volunteers

We need more hands to help with administration if our Society is to realize its full potential. We are a voluntary organization but at present there are too few people running our affairs. It is appropriate therefore to end this report by recording our grateful thanks to all the officers and helpers within the Society.

Members of Council (the Trustees), 1 July 1999–30 June 2000

N. Anderson*
E. B. Bangerter
A. J. Barrett* (Secretary)
K. F. Betton
D. Bevan
R. A. Blades, w.e.f. 6 December 1999
Mrs D. Brookman, until 6 December 1999
Dr C. Bowlt* (Chairman)
Miss E. P. Brown
R. M. Burton*
R. E. Butler
R. A. Carpenter, until 6 December 1999
Dr P. F. S. Cornelius
Miss R. Day
Miss N. A. Duckworth*
R. S. R. Fitter* (President)
R. W. Hale
V. F. Hancock, deceased 16 February 2000
Miss V. S. Harley
Mrs L. Hewitt
Dr J. F. Hewlett
P. C. Holland
K. H. Hyatt
Miss M. E. Kennedy, deceased 24 July 1999
Mrs I. J. Kettle, w.e.f. 6 December 1999
A. J. Leppard*
Mrs J. R. Lord, until 25 October 1999
Miss M. L. Medina, w.e.f. 6 December 1999
Dr I. S. Menzies
D. J. Montier
E. M. Nicholson
R. M. Payne
C. W. Plant
C. Robinson
Mrs C. M. Schmitt
P. J. Sellar
Dr M. C. Sheahan
R. A. Softly
J. M. W. Topp, until 6 December 1999
Miss F. J. Turtle, w.e.f. 6 December 1999
M. J. West* (Treasurer)
H. M. V. Wilsdon*

*Members of Administration and Finance Committee as at 30 June 2000.

Treasurer's report for 1999/2000

At the end of the financial year on 30 June 2000, the total net assets of the Society were £508,196, compared with £489,532 the previous year, representing an increase of 3.81 per cent.

Incoming resources for the year were £35,072, compared to £38,128 the previous year,representing a fall of 8 per cent. Subscription income (inclusive of tax recoverable on covenanted subscriptions) fell from £16,589 to £16,333 and donations fell from £686 to £304. Income from sales of the Society's various publications fell from £2,333 to £1,963. Investment income fell by around 11 per cent from £18,310 to £16,278 (net). However, the market value of the Society's portfolio of investments rose from £483,988 to £506,323.

Overall expenditure during the year was £60,930 compared with £45,846 in 1998/9, with most elements (including all management and administrative expense) remaining at about the same level as the previous year apart from a donation made to The Wildfowl and Wetlands Trust amounting to £20,000.

London Bird Report No.63 for 1998 would normally have been published during this year, but there have been production delays. No provision for the costs of publication has been made in these financial statements. The effect of this however was substantially offset by production costs for *The Natural History of Buckingham Palace Garden* Part 1.

The difference between incoming resources and expenditure was, this year, more than balanced by the profit from sales of investments, which have all been reinvested.

Reserves policy

The majority of unrestricted general funds can be regarded as expendable endowment since they are invested to provide a regular source of income as well as capital growth for the Society.

Statement of trustees' responsibilities

Charity law requires the trustees to prepare financial statements for each financial year which give a true and fair view of the state of affairs of the charity and of its financial activities for that period. In preparing those financial statements the trustees are required

- to select suitable accounting policies and then apply them consistently;
- to make judgements and estimates that are reasonable and prudent;
- to state whether applicable accounting standards have been followed subject to any material departures disclosed and explained in the financial statements; and whether the financial statements have been prepared in accordance with the Statement of Recommended Practice 'Accounting by Charities';
- to prepare the financial statements on the going concern basis unless it is inappropriate to presume that the charity will continue to operate.

The trustees are responsible for keeping proper accounting records which disclose with reasonable accuracy at any time the financial position of the charity and to enable them to ensure that the financial statements comply with the Charities Act 1993. They are also responsible for safeguarding the assets of the charity and for taking reasonable steps for the prevention and detection of fraud or other irregularities.

Report of the auditors to the members of the London Natural History Society

We have audited the summary financial statements set out on page 11.

Respective responsibilities of trustees and auditors

The summary financial statements are the responsibility of the trustees. Our responsibility is to report to you our opinion on their preparation and consistency with the full financial statements and Annual Report.

Basis of opinion

We conducted our audit in accordance with Auditing Guideline, *The auditor's statement on the summary financial statement*, adopted by the Auditing Practices Board.

Opinion

In our opinion the summary financial statement is consistent with the full financial statements and Annual Report of the Society for the year ended 30 June 2000.

4 London Wall Buildings
LONDON EC2M 5NT
3 October 2000

BAKER TILLY
Chartered Accountants
and Registered Auditors

Summarized accounts for the year ended 30 June 2000

These summarized accounts have been extracted from the Society's annual accounts for 1999/2000. They may not contain sufficient information to provide a full understanding of the financial affairs of the Society. For further information the full accounts, the auditors' report on these accounts and the trustees' report should be consulted. Copies can be obtained from the Society's Hon. Treasurer, M. J. West, 52 Trinity Road, Ware, Hertfordshire SGl2 7DD.

The annual accounts were approved by the trustees on 3 October 2000.

Summarized statement of financial activities for the year ended 30 June 2000

	Unrestricted funds	
	2000	1999
	£	£
Incoming resources		
Subscriptions received from members	16,333	16,589
Interest receivable	194	210
Investment income	16,278	18,310
Publications/journals income	1,963	2,333
Other sundry income (including donations and bequests)	304	686
Total incoming resources	35,072	38,128
Resources expended		
Direct charitable expenditure	49,371	33,347
Management and administrative expenses	11,559	12,499
Total resources expended	60,930	45,846
Net (outgoing) resources for the year	(25,858)	(7,718)
Gains and losses on investments		
Realized gains on sale of investments	84,265	37,802
Unrealized (losses)/gains on revaluation of investments	(39,743)	(20,101)
Net movement in funds	18,664	9,983
Fund balance brought forward at 1 July 2000	489,532	479,549
Fund balance carried forward at 30 June 2000	£508,196	£489,532

Balance sheet as at 30 June 2000

	2000	1999
	£	£
Fixed assets		
Tangible fixed assets for use by charity	1,136	2,069
Investments at market value: listed	490,186	472,940
cash	16,137	11,048
	507,459	486,057
Net current assets/(liabilities)	737	3,475
Total net assets	£508,196	£489,532
Represented by:		
Unrestricted funds	£508,196	£489,532

Official and sectional reports for 2000

CONSERVATION

An important landmark for nature conservation in London was reached in January 2000 when the London Biodiversity Partnership (of which the Society is a member) held a conference to launch the first phase of its action plan, the Biodiversity Audit. This foundation document describes the major habitats and species present in the capital, the threats to them and the opportunities for their conservation. It will form the basis of the unfolding London Biodiversity Action Plan which will have strong links with the Mayor of London's Biodiversity Strategy. Meanwhile, individual boroughs and neighbouring counties around London have been developing their own Local Biodiversity Action Plans. All this welcome activity has meant that biological recording has become a major conservation issue.

The National Biodiversity Network now has formal existence as a company limited by guarantee with charitable status. Membership will be largely confined to nominees of organizations and the Society will need to decide in due course whether to apply for associate membership (the category appropriate to natural history societies). In the meanwhile, work has just started within the London Biodiversity Partnership on defining and agreeing standards for site definition as a first step towards full agreement of recording standards among all partners working in the same area.

The Conservation Officer, Secretary, and other members of the Nature Conservation Working Group continue to comment on behalf of the Society on planning applications — a task which is probably more necessary than ever in view of the political pressure to increase the amount of building in London. Much of this pressure is now falling on areas of previously developed land, which the government calls 'brownfield sites'. Many such sites have developed into diverse habitats of considerable nature conservation importance and the Wastelands Forum (set up in 1998) has now developed a detailed habitat action plan designed to defend the best of them and to counter threats to their survival. The Conservation Officer and the Secretary of the Group are both active members of this Forum and the wasteland habitat action plan will form part of the second volume of the London Biodiversity Action Plan (LBAP) due to be launched in January 2001. This volume will also include habitat action plans for London's woodland, chalk grassland and heathland in addition to species action plans for bats, water vole, grey heron, peregrine, sand martin, black redstart, house sparrow, stag beetle, tower mustard and mistletoe. The Conservation Officer prepared, for further inclusion, an account of 'London's exotic flora' —plants that have originated overseas and become naturalized in London. They form an important element of the urban flora and, although a few cause problems through their vigorous encroaching growth, most are benign and add colour and diversity to many parts of London.

The Nature Conservation Working Group continued their activities with three survey visits during the year. In May they visited Morden Cemetery to look for green-winged orchid *Orchis morio*. None was found, but much data were gathered about the rest of the flora. In June they visited the lake on Wandsworth Common to carry out a baseline botanical survey which will enable the Council to monitor changes in the flora following extensive refurbishment work. In September they returned to Morden Cemetery to carry out a botanical survey of the boundaries and to assess their nature conservation value. We are most grateful to Freda Turtle for co-ordinating this work.

DAVID BEVAN, *Conservation Officer*
RUTH DAY, *Secretary, Nature Conservation Working Group*

BOTANY

The Botany Section has had another good year with an interesting and varied programme of talks and field outings. Two formal meetings were organized: at the end of January Sue Buckingham gave us an illustrated talk on the wild flowers of the Cape region in South Africa, and on 30 October Peter Marren was due to give a talk called 'Saving rare flowers — are we overdoing it?' However that was a day of wild storms which disrupted public transport and brought down electricity power lines, so Peter Marren was unable to attend and the meeting had to be postponed to 2001. Informal meetings included the usual best botanical slides in January, and two useful plant identification sessions in July and September.

During the past year members have been able to enjoy a variety of field trips all over the London area and beyond. There were visits to: the herbarium at The Natural History Museum, Warley Place, Abbey Wood (with the British Naturalists' Association), Bourne Walk, Shadwell Wood, Home Park and Thames towpath, Hartslock and Marlow, Ivinghoe Beacon, the Merstham area, Hadleigh Downs, Hatfield Forest (with BSBI), Tower Hamlets Cemetery, Rainham Marshes, Chingford Plain and Sewardstonebury, Albury Heath, the Grand Union Canal at West Drayton, the Warburg BBOWT Reserve, the North Downs near Ranmore, Dagenham Chase LWT Reserve, Hampstead Heath for ferns, and the always popular fungus foray in Haringey with the LWT. Field trips continue to be enthusiastically attended, and members obviously appreciate them for their friendliness and the opportunity to learn plant identification skills.

We are as always very grateful to all the speakers and leaders who give us their time and expertise, and also to our meetings secretaries for the hard work involved in organizing these events.

Mary Clare Sheahan resigned as representative on Council and Robin Blades kindly agreed to take over from her.

DAVID BEVAN, *Chairman*, MARY CLARE SHEAHAN, *Secretary*

ECOLOGY AND ENTOMOLOGY

The year saw the demise of the Ramblers, Archeology and Geology Section, and at the request of Council, our Section agreed in principle to incorporate the geological element. However we are still seeking a member willing to arrange indoor and field meetings of a geological nature. We also continue to look for an Indoor Meetings Secretary to arrange talks on entomological and ecological topics.

During the year the committee appointed Leslie Williams as Recorder of Lepidoptera (butterflies) while Colin Plant will continue as Recorder of Lepidoptera (moths). Paul Mabbott has been appointed Recorder of Coccinellidae in addition to his existing post as Recorder of Carabidae.

The Section continues to arrange a varied programme of meetings indoors and in the field. At February's informal meeting members showed beautifully photographed slides of insects they had seen during the year. Two meetings were held in March: the first was a talk given by Helen Firminger on 'Searching for Mexico's carnivores' and at the second Ann Brown presented an update on conservation in the Falklands, following her talk to the Society two years previously. Two lectures previously arranged by the Geology Section were by Dr David Brook on 'Geology and penguins' in May and by Andrew Graham on 'Meteorites — messengers from space' in June. Also in June we heard Steve Kett talk about his researches on the fish of Barn Elms, the new Wetland Centre. In September we were guests of the British Entomological and Natural History Society for the Brad Ashby Memorial Lecture when Dan Hackett spoke on 'Finding London's insects'. Our AGM once again received the reports of ten of our recorders in addition to a talk by Leslie Williams on the transect method of recording butterflies. This format turned into a mini-seminar with recorders able to compare notes on the effect of the unusually wet summer on the various taxa. The Section also arranged the Millennium Lecture given in November by Colin Bowlt, on 'The Buckingham Palace Garden Survey — in perspective'.

Five field trips were organized during the year. In May, a range of species were found in Dollis Valley near Finchley. The poor weather for a trip in June to a known site for glow-worms prevented any being seen, but the caterpillar of the emperor moth was found. Another wet day, this time in August at Wraysbury, failed to produce sight or sound of the great green bush-cricket but a number of other insects were seen. In September rotting logs and posts on Wimbledon Common yielded many larvae of large and small stag beetles, and of the rose chafer. In November members explored Hampstead Heath, chiefly for its geology.

Once again the Section represented the Society at the Amateur Entomologists' Society exhibition, selling maps, books and journals as well as making the work of the Society known to a wider public.

JOHN A. THOMPSON, *Chairman*, CATHERINE SCHMITT, *Secretary*

ORNITHOLOGY

As the Section was without an Indoor Meetings Secretary following the resignation of David Montier at the end of 1999, only four talks were presented, in the first four months of the year — on the work of the Runnymede Ringing group, 'Freedom is a place called Ardnamurchan', 'Wildlife and conservation of the Essex coast' and, in the absence of the booked speaker, bird song, presented by the the Chairman. Following the AGM in November, our BTO contact, Derek Coleman gave 'An account of the Breeding Bird Survey in London'. But a very good piece of news at the end of the year was that Nicola Overington offered to take over as Indoor Meetings Secretary so that a lecture programme could be resumed from autumn 2001.

There was again a full programme of field meetings, with an outing almost every weekend. Coach trips were run to a range of good and seasonal locations, and there was a varied programme of visits to local sites. A particularly successful coach trip was the one to Holkham on the north Norfolk coast in February. Fine views were had of twites, shorelarks and snow buntings along the bay, followed by the spectacle of flocks of pink-footed, white-fronted and brent geese inland. The day ended with the coach calling in a mile down the road at Wells to catch views of a stunning rarity — a red-breasted goose. Visits to sites in and around the London area itself produced their own memorable experiences, such as the sight of a long-eared owl at the North Kent marshes, and the magic of birdsong at Bookham Common. These field trips continued to be well supported, and thanks go to the members volunteering to lead them as well as to Neil Anderson once again for his hard work in organizing the programme. After six years Neil is enjoying a well-earned rest from that but continuing to arrange the coach meetings, while Jennifer Hayden has agreed to take over as Field Meetings Secretary.

Many members took part in the Naturalised Goose Survey organized jointly by the BTO and WWT, as well as in a number of running BTO surveys, such as the Waterways Bird Survey, Breeding Bird Survey and Heronries Census.

It was disappointing that the *London Bird Report* for 1998 was not published, but there was good news at the end of the year in that Andrew Self had volunteered to take over as Editor with high hopes of getting it published in the first half of 2001. The two-monthly *Ornithological Bulletin* has continued to provide a wide range of interesting records from the London area, thanks to the large number of observers submitting records and admirable editing. After more than six years as Editor, David Montier has handed over to Nick Tanner, so ending countless years of dedicated service which David has given to the Section in many important posts. His quiet competence in the performance of all these tasks will be greatly missed. and a huge debt of gratitude is owed to him.

RON KETTLE, *Chairman*, NICOLA DUCKWORTH, *General Secretary*

The wildlife of the London Area in 2100. Crocodiles or polar bears?

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Presidential Address delivered at the Annual General Meeting on 6 December 2000

Late Victorian naturalists and writers used to speculate on what might happen if London were destroyed and nature took over again. Richard Jefferies in *After London* and William Morris in *News from Nowhere* both tried their hand at this. Jefferies, you may remember, imagined that domestic stock left free to roam turned into two kinds of cattle, four kinds of pig and three kinds of dog, while beavers escaped from zoos to build dams on woodland streams and wild deer appeared in herds numbering up to a thousand.

Today we do not look backwards but forwards. We know that change is on the way, indeed is already happening, since the climate is already nearly three-quarters of a degree warmer than it was in the mid seventeenth century and half a degree warmer than it was a hundred years ago. This global warming is generally attributed to the increase in our atmosphere of the greenhouse gases, notably carbon dioxide, which are produced largely by the burning of fossil fuels, such as coal and oil. They are so called because they have the same effect as the glass of a greenhouse in keeping the heat generated by the Sun within the atmosphere.

We now know that not only have four of the five warmest years since 1659 occurred in the past eleven years, but the number of really cold days per year has fallen from fifteen to twenty in the eighteenth century to about ten in the twentieth century, while the number of really hot days per annum has also significantly increased, most notably in 1976, 1983, 1995 and 1997. Moreover the official forecast is that this trend will continue, so that our temperature will rise by something between one and three degrees centigrade during the present century, while by 2050 summers as hot as 1997 may occur four times per decade. A less welcome trend has been the increase in the number of gales and severe gales. We all remember those of 1987 and 1990 and a few weeks ago we had yet another. Some of you, like me, may have a vivid memory of the large tree that crashed into the Herbarium of the Royal Botanic Gardens on Kew Green during the October 1987 gale. So what is likely to be the impact of global warming on the London Area in a hundred years time, by the year 2100?

Ornithologists in particular are conscious of the natural changes that have already taken place in the past half-century. Some of us can remember how eager we were for our first sight of what is now rather a common bird, the collared dove *Streptopelia decaocto.* Quite a number of other birds now breed in Britain that were not doing so when I started my bird-watching career in the 1930s, little egret *Egretta garzetta*, Cetti's warbler *Cettia cetti*, firecrest *Regulus ignicapillus* and redwing *Turdus iliacus,* to mention only a few that have arrived under their own steam, besides such deliberately or accidentally introduced birds as white-tailed eagle *Haliaeetus albicilla* and black swan *Cygnus atratus.* We still await the return of the red kite *Milvus milvus* to breed in the trees around the church of St Giles in the Fields, but with the recent very successful reintroduction in the Chilterns, that may yet come.

To start with, although we know the climate is changing, we cannot tell just how fast it will do so in the next hundred years. The UK Climate Change Impacts Programme offers us four scenarios, with the temperature rise varying from one to three degrees centigrade, each associated not only with different levels of concentration of carbon dioxide in the atmosphere but also with rising sea levels. Then there is the joker in the pack, the Gulf Stream.

It is, of course, entirely due to the Gulf Stream that our climate is not as harsh as that of Labrador, and we know that on occasions in the fairly distant past it has flipped, and the climate in the British Isles has actually been as cold as Labrador is today. The problem is the present huge accumulation of fresh water in the form of ice on the Greenland ice cap, which has been estimated at 10 per cent of all the fresh water on Earth. The more of this that melts due to global warming, the less almost freezing water will sink to the bottom in the Greenland Sea. This mass of freezing water near the sea bed is one of the pumps that help to push the ocean currents, including the Gulf Stream, around the globe. The worst scenario here is that the Gulf Stream might be switched off altogether, and icebergs, complete with polar bears *Thalarctos maritimus* and walruses *Odobenus rosmarus* might really return to the British coasts. It is slightly reassuring that this worst-case scenario, the sudden complete collapse of the circulation mechanism of the world's oceans, which would lower the temperature of our adjacent seas by several degrees centigrade, has not yet been seen in any experiment using comprehensive climate models. Into the further horrors that might occur if the West Antarctic Ice Sheet were to disappear as well, I refrain from taking you.

So we have wide variations of climate within which to speculate: from cold enough for polar bears to hot enough for crocodiles. But before we get too excited at either prospect, we must reflect on the normal slow rate of progress when animals and plants spread naturally. 'What about the collared dove, then?', you may say. But birds with the advantage of flight can always move faster than mammals and other land-bound animals. The English Channel and the North Sea are going to remain during the twenty-first century a substantial barrier to invading animals not gifted with flight, as they are already even for some birds, such as the crested lark *Galerida cristata,* present for many years on the dunes at Calais but not yet at Dover. It could be that we await some natural force, such as a strong easterly gale, to carry a small flock of crested larks across the Strait and start what would surely be a successful invasion of at least south-eastern England, including the London Area.

Another important factor is the sea level. The melting of the polar and Greenland ice-caps will produce a general raising of the oceanic sea level, accentuated by the fact that water expands as it warms up, varying between two and nine centimetres per decade, according to which scenario actually happens. However, northern Britain, still recovering from the weight of ice imposed on it in the Ice Age, is independently slowly rising, so that south-eastern England is even now slowly tilting into the sea. By 2050 the north of Scotland will be rising by as much as 11 cm per decade, while East Anglia will be falling by as much as an extra 9 cm per decade.

The one thing we can be sure about is the effect of this rising sea level on coastal habitats, and in particular on mudflats and saltmarshes, which under normal circumstances, i.e. in the absence of man, would gradually move inland. All our coastal defences are at present designed to prevent this, so that if we do not wish to see the disappearance of the saltmarsh habitat in the Thames Estuary part of our area, we must hope that the conservation techniques already being applied a little further north to preserve the Essex saltmarshes will be applied here too. Otherwise our successors in 2100 will have to catalogue the loss of a great many saltmarsh plants and invertebrates to the London Area. As regards birds, recent research by the British Trust for Ornithology shows that habitat quality on the east coast will deteriorate for all waders except oystercatcher *Haematopus ostralegus.*

This scenario is also likely to call within the next twenty to thirty years for a larger and stronger Thames Barrier. If this were not forthcoming, say perhaps because the government of the day had vowed not to increase taxes, one can imagine the sea eventually reclaiming that extensive tract of marshes we now call Bermondsey and Rotherhithe. If so, late twenty-first century travellers along the Old Kent Road, built up, as it would have had to be, on an embankment, might again enjoy the sight of marsh harriers *Circus aeruginosus* skimming over the marshes, just as their early Victorian ancestors did. And along with marsh harriers would go a whole host of other birds, such as bittern *Botaurus stellaris,* spotted crake *Porzana porzana* and Savi's warbler *Locustella luscinioides,* not to mention the possibility of swallowtail butterfly *Papilio machaon,* though I think this would have to be the invading Continental race, which might anyway have established itself in the South-East, being much less choosy about its habitat. But a word of warning. If mink *Mustela vison* had been allowed to establish themselves even more firmly than they have been in the twentieth century, maybe the breeding avifauna of the South Thames National Nature Reserve (for surely it would have had to be so declared) might prove to be not nearly so interesting.

The crested lark is a sedentary bird, but so is Cetti's warbler, so it is reasonable to assume that in the next hundred years more birds, both sedentary and migratory, will move northwards in western Europe. The birds already showing signs of this movement, such as the fan-tailed warbler *Cisticola juncidis* are the most likely to cross the Channel and establish themselves here. However suitable the climatic and ecological conditions might be for birds currently not found north of the Sahara, it is highly unlikely that African birds such as hamerkop *Scopus umbretta* or malachite kingfisher *Alcedo cristata,* not to mention hippos or crocodiles, will get here by natural means in the next hundred years. One can, however, imagine marabou storks *Leptoptilos crumeniferus,* escaped from a zoo, stalking about among the screaming gulls at a refuse site, and later establishing a breeding colony. And if storks at Rainham, why not crocodiles in the Lea or Medway? Since sixteen species of non-native waterfowl, not to mention night herons *Nycticorax nycticorax,* golden pheasants *Chrysolophus pictus,* and ring-necked parakeets *Psittacula krameri,* already breed or have bred in Britain, it would be a bold man who would predict which of these and others would be established breeders in the London Area in a hundred years' time.

A further thought occurs. Since a main reason for bird migration is lack of food during the winter, if global warming increased the amount of that food, would our present bird migration system between the British Isles and sub-Saharan Africa continue? Already we see many wintering blackcaps *Sylvia atricapilla* and chiffchaffs *Phylloscopus collybita.* Shall we by the end of the century see wintering swallows *Hirundo rustica,* swifts *Apus apus* and cuckoos *Cuculus canorus* too?

Bats, butterflies and moths are the other principal flying animals that we notice. By the end of the century we could well have the mouse-eared bat *Myotis myotis* as an established member of our mammal fauna, instead of an occasional short-term colonist along the south coast. And it seems reasonable to suppose that painted ladies *Vanessa cardui*, red admirals *Vanessa atalanta* and clouded yellows *Colias croceus* will become residents, while the species that already visit us irregularly, such as the pale clouded yellow *Colias hyale,* Queen of Spain fritillary *Issoria aurinia* and short-tailed blue *Cupido argiades* will perhaps establish a few breeding colonies that might well extend into our area. Indeed the Queen of Spain has already been suspected of breeding in both Cornwall and Suffolk.

The general effect of global warming is also reflected in the recent northward spread of comma *Polygonia c-album,* brimstone *Gonepteryx rhamni* and gatekeeper *Pyronia tithonus* butterflies and the green silver-lines moth *Psudoips fagana* into Yorkshire, as well as orange-tip *Anthocharis cardamines,* pearl-bordered fritillary *Boloria euphrosyne,* and other butterflies into and onward in

Scotland. Specialists in dragonflies, grasshoppers and crickets are also recording northward advances of insects that we already have around London. These include such dragonflies as ruddy darter *Sympetrum sanguineum,* migrant hawker *Aeshna mixta* and emperor *Anax imperator,* which last year bred in Huddersfield, Yorkshire; and such orthopterons as long-winged and short-winged coneheads *Conocephalus discolor* and *C. dorsalis,* along with Roesel's bush-cricket *Metrioptera roeselii.* We can expect that these will be joined by other species that actually spread into our area from the south.

Non-flying land-bound animals are held up by water barriers, but animals and plants that live in the sea can go where they like, so long as the water is warm or cool enough. This is shown not only by the fact that leatherback turtles *Dermachelys coriacea* are already increasingly reported from our coastal waters — one was found in the Thames Estuary in November 1998 (Langton 1999) — but also by the rapid spread around our coasts of the accidentally introduced Australian barnacle *Elminius modestus* and Japanese seaweed *Sargassum muticum,* as well as the common cord-grass *Spartina anglica* which began as a hybrid between our native *Spartina maritima* and the North American *Spartina alterniifolia* on Southampton Water. So if our seas warm up, we may well acquire other marine turtles as regular visitors before the end of the century, and the various fishes, such as the sea-horse *Hippocampus hippocampus** and marine invertebrates already becoming more numerous on our south-western coasts may spread much further north and east. We may also reasonably hope eventually to see the siphonophore, Portuguese man 'o war *Physalia physalis* and the hydroid by-the-wind-sailor *Velella vella* occasionally in the Thames Estuary. However the absence of rocky coasts in the London Area is likely to reduce the opportunities our successors have for encountering some of the more interesting animals.

Another certainty is that our fresh waters will warm up, so that freshwater species which need cold water will retreat northwards. One sad probability arising from this is that by the end of the century the Atlantic salmon *Salmo salar,* so splendidly and with such effort restored to the Thames during the twentieth century, will be lost again in the twenty-first.

Predicting the effect of global warming on plant life in the London Area, apart from the potential danger to saltmarsh plants, is more problematical. Plants with wind-borne seeds may spread fast enough, as Oxford ragwort *Senecio squalidus* has done in the past and its congener narrow-leaved ragwort *Senecio inaequidens* bids fair to do in the near future. But those that rely on slower methods naturally spread much more slowly, and these have to cross the Channel too, if they are spreading slowly north in Europe. So although we may acquire a Mediterranean climate, it may take us a very long time to acquire a Mediterranean flora. Thus scrub will not become true maquis, but will continue to be based on hawthorn *Crataegus* scrub with doubtless an admixture of such bird-sown garden shrubs as lavender *Lavandula* and bladder senna *Colutea arborescens,* not to mention the buddleia *Buddleja davidii* of which we already have too much. However, the existence already of woods of holm oak *Quercus ilex* on the downs of the southern Isle of Wight, as well as on the Exmoor coast, suggests that we might find these also on the North Downs in a hundred years' time. Perhaps the greatest danger to the plants of the London Area is that the human population of London will continue to grow at such a rate that most of our best habitats will be built on by 2100. We have a Mayor who is a naturalist today. Let us hope that those in power in fifty and a hundred years' time will be equally keen to preserve the wildlife of our Area.

Unlike birds and butterflies, few if any of our native plants have shown signs of moving northwards as the climate has grown warmer in the century we have just left. A possible instance is the military orchid *Orchis militaris* colony in Suffolk, believed to have arrived by airborne seed direct from the Continent. Plants without airborne seeds cannot jump the Channel to do so and plants moving by that other airborne method, on the feet of waterfowl, usually seem to come from the north rather than the south. Indeed there are more instances of the southern limits of northern plants moving northwards, such as the coastal oysterplant *Mertensia maritima* lost now from both Norfolk and Northumberland.

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* Within a week of delivering my Address, the sighting of a sea-horse in the Thames Estuary, the first since the very hot year of 1976, was announced.

The major problem is that patches of good habitat, even such widespread ones as heaths and chalk grassland, tend to become increasingly fragmented and isolated, so that it becomes harder and harder for plants that prefer particular habitats to spread. I know of no indication, for instance, that round-headed rampion *Phyteuma orbiculare,* locally frequent on the chalk of the South Downs, either has spread or is likely to spread to the North Downs, or that wild gladiolus *Gladiolus illyricus* or any of the other localized heathland species of the New Forest have spread or are likely to spread to the Greensand heaths of the Hampshire/Surrey border. I fear that for botanical novelties in the London Area a hundred years hence we may have to rely on the equivalents of giant hogweed *Heracleum mantegazzianum,* Japanese knotweed *Fallopia japonica* and other aggressive invaders that have stormed the London Area during the twentieth century, just as the most obvious new arrivals during the nineteenth century were weeds such as pineapple weed *Matricaria discoidea* and common field speedwell *Veronica persica.*

So finally, if you want me to stick my neck out and make some actual predictions of the new arrivals among our flora and fauna, I shall offer you the Norway maple *Acer platanoides,* already here but bidding fair to challenge its congener the sycamore *Acer pseudoplatanus* in our woods; the Swedish whitebeam *Sorbus intermedia,* already well established on Hampstead Heath, which I have myself seen in six English counties and Aberdeenshire; holm oak *Quercus ilex,* as already suggested, forming woods on the North Downs; the ragwort *Senecio inaequidens,* already all over industrial Thames-side; the Japanese seaweed *Sargassum muticum* swarming upstream as far as Teddington Lock; the mouse-eared bat, perhaps established in old quarries in the North Downs; the crested lark, who knows?, breeding in an increasingly arid Richmond Park; one of those tiresome North American aquarists' throw-out terrapins breeding in the Pen Ponds and perhaps even in the Serpentine and the lake in Buckingham Palace grounds; and the Queen of Spain fritillary breeding freely on the field pansy *Viola arvensis,* for which the Mayor has ordered a field to be regularly ploughed on the edge of Hampstead Heath.

Reference

LANGTON, T. E. S. 1999. Leatherback turtle *Dermachelys coriacea* from the Thames Estuary, with notes on reporting and rehabilitation. *Lond. Nat.* **78**: 103–106.

Book review

The Millennium atlas of butterflies in Britain and Ireland. Jim Asher, Martin Warren, Richard Fox, Paul Harding, Gail Jeffcoate and Stephen Jeffcoate. Oxford University Press with Butterfly Conservation, Biological Records Centre and The Dublin Naturalists' Field Club. 2001. Hardback, 433 pp. with 270 full-colour illustrations. ISBN 0 19 850565 5. £30 plus £2.50 postage and packing from Oxford University Press, Direct Sales Department, Freepost NH 4051, Corby, Northants NN18 9BR, or on-line via www.oup.com, or from booksellers.

Leafing through the pages or seeking detail from this book reinforces one crucial message. Butterflies are dependent upon their habitat. And it is the loss of habitats that has led to the decline of many species of butterfly in Britain and Ireland during the last century. Despite that, some species of the wider countryside are increasing their range and abundance.

'The Butterflies for the New Millennium' project involved a comprehensive resurvey of the distribution of butterflies in Britain and Ireland between 1995 and 1999. The success of the project was due to co-operation between many organizations and in particular from thousands of volunteers. Data were utilized from a range of sources, though two main survey methods were employed: traditional distribution mapping (butterflies recorded by grid reference) and data from over 500 transects that are walked weekly from April to September.

This book is a major reference work. It is readable too, and well illustrated with maps, graphs and photographs. The introductory chapters cover the background to the project, butterfly habitats, recording and data collection, and interpreting the data. The main body of the book is taken up by the species accounts. For each species there is a full-page distribution dot map at 10-km square resolution. For species where the range has declined a comparison is made with the distribution in 1970–1982 and pre-1970. For species with an increasing range, a separate, smaller map is presented. Each species account includes a colour photograph, a summary, together with detail about the ecology of the species, habitat information, status, and sections on 'distribution and trends' and 'interpretation and outlook'.

The final chapters cover the pattern and cause of change, and conserving butterflies. There are several appendices including one with a phenogram for most of the species. Phenograms display the abundance of each butterfly species during the year plotted against latitude. Thus shifts in the flight time from south to north can be highlighted, together with the timing of 'broods'. For example, the small heath *Coenonympha pamphilus* has two or three generations in the south, but a single generation in the north.

This work updates the maps in *The butterflies of the London Area* (Plant 1987), though a direct comparison is difficult as the London atlas employed a finer, 2-km square resolution. Certainly some species have increased in London since 1980–1986, particularly the 'wider countryside species' identified in *The Millennium atlas*. These include the brimstone *Gonepteryx rhamni*, purple hairstreak *Neozephyrus quercus*, peacock *Inachis io*, comma *Polygonia c-album*, speckled wood *Pararge aegeria* and gatekeeper *Pyronia tithonus*. Several of these species are also expanding northwards in Britain and there is evidence that this is related, at least in part, to climatic change. However, some other 'wider countryside species' are declining locally, though their national range remains stable. The small copper *Lycaena phlaeas* and small heath *Coenonypha pamphilus* are two examples of species that are declining nationally and in London. In the countryside these declines may be due to the loss of semi-natural grasslands and rough grazing. The wall *Lasiommata megera* declined rapidly in the 1990s throughout large areas of southern and central Britain. For the 'habitat specialists', the other main category of butterflies identified by the book, there is an urgent need for conservation of their habitats. Whilst London provides little remaining habitats for these species, populations of a few species survive on the edges of London, e.g. the chalkhill blue *Polyommatus coridon*.

The message for conservation is the need to conserve and restore habitat. That includes the habitat of the specialist butterflies, and of the landscape throughout the wider countryside, particularly grasslands and woodlands. Agricultural policy needs to be reformed and sustainable development adopted. Whilst opportunities to re-create specialist habitat in London are limited, the inference from the species accounts is that London with its gardens, woodlands and nature areas can play a role in the conservation of the 'wider countryside species'.

Leslie Williams

Quercus × *turneri* Willd. — a rare London hybrid oak

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Abstract 21
First records of Turner's oaks 21
Turner's oaks today 22
Appearance and characteristics of *Quercus* × *turneri* Willd. 25
Description 25
Acknowledgements 27
References 27

Abstract

Spencer Turner had a nursery at Leyton, Essex, from 1751 to 1776. During this period he raised the two forms of hybrid oak which bear his name, both derived from *Quercus ilex* holm oak and *Q. robur* pedunculate oak. The first has never been given a clonal name, whilst the other is known as *Q.* × *turneri* 'Pseudoturneri', although it has often been distributed as *Q.* × *turneri.* The latter is fairly widely known and remains in cultivation, but the original clone is on the verge of extinction. Until recently there appeared to be only two surviving examples in Britain, but in 1998 two further trees were identified in London parks. In 2000 a specimen was found in Ireland. Both forms of Turner's oak are described below, and we propose the cultivar epithet 'Spencer Turner' for the original hybrid.

First records of Turner's oaks

Spencer Turner's nursery was situated at Holloway Down (in the vicinity of present-day Langthorne Road), Leyton, Essex, where he leased some three acres from 1751 until his death, aged 48, in 1776 (Crouch 1946). This was a period of intensive tree-planting in Britain and there were many nurseries located around London. Property owners were landscaping their estates, and competing for exotic species and unusual specimens. Nurseries planted acorns freely in hope that by chance an outstanding hybrid might emerge. In this lottery Lucombe and the Fulham nursery were lucky with *Quercus cerris* × *Q. suber*, and Turner with *Q. ilex* × *Q. robur.* Clones of their respective hybrids, propagated by grafting, were much in demand and were widely distributed at home and abroad. Two forms of his hybrid were distributed by Turner. One, represented by the tree sent to Berlin and from which the hybrid *Quercus* × *turneri* was described, referred to here as the original form, and a second, more common in cultivation, now referred to as *Q.* × *turneri* 'Pseudoturneri'.

A notable early reference to Turner's oak was by the great French naturalist Lamarck in his *Encyclopédie Méthodique* (1783). He describes three unusual oaks growing in the grounds of the Trianon palaces at Versailles — Lucombe, Fulham and Turner's. 'The Turner's oak . . . which is claimed to have been found among hybrids raised in England, and then multiplied by grafting, is specially remarkable for the shape and consistency of its leaves. Its shoots, which are glabrous, bear oval leaves, very flat, coarsely toothed, slightly leathery, glossy and dark green above, lighter green and almost completely glabrous below, only when young having occasional hairs on their underside. These leaves are broader than those of the two preceding oaks [Lucombe and Fulham], but not longer than them; when mature they are entirely glabrous on both sides.'

The two forms of Turner's oaks have been much confused, in particular by Loudon (1838). Elwes and Henry (1910), apparently following Loudon, took the Trianon tree to be 'Pseudoturneri', but Lamarck's references to oval leaves, broader but not longer than Lucombe and Fulham oaks, suggest that it is more likely to have been the original clone. 'Pseudoturneri' has elongated leaves, often longer than those of the two latter hybrids, and also commonly with very distinctive narrow-cuneate bases which Lamarck could hardly have failed to notice.

Lamarck's herbarium is preserved in the Muséum National d'Histoire Naturelle in Paris, and includes specimens from the Trianon oaks. These have recently been examined by Prof. G. G. Aymonin, who compared them with illustrations of leaves from both forms of Turner's oaks in London parks. Of a specimen labelled '*Quercus*' 'de Trianon', without any Latin name, he states: 'Il y a davantage de ressemblance avec le *Quercus* × *turneri* Willd. de Hyde Park de votre xerocopie, et beaucoup moins de similitudes avec 'Pseudoturneri' de Holland Park.' (There is more resemblance to the Hyde Park *Quercus* × *turneri* Willd. of your photocopy, and much fewer similarities to the Holland Park 'Pseudoturneri'.) This conclusion appears to confirm that the Turner's oak in the Trianon gardens in 1783 (six years before the French Revolution) was indeed an example of the original clone.

These Trianon oaks are likely to have been supplied by Loddiges nursery in Hackney, east London. Conrad Loddiges (1738–1826), born and trained in Germany, was in business there by 1777, when he published a trilingual catalogue in English, Latin and German (Solman 1995). He had a flourishing trade with Continental Europe during the late eighteenth and early nineteenth centuries. This included supply to the Royal Botanic Garden, Berlin (Loudon 1838) of the Turner's oak from which the hybrid was described by Willdenow (1809). It was published in an inventory of the Garden. It is in Latin and very brief: 'foliis oblongis grosse mucronato-dentatis, utrinque glabris, basi subcuneatis, ramulis pilosis' (leaves oblong with large mucronate teeth, glabrous, base subcuneate, twigs hairy). He gave the native habitat as Tibet, being confused 'between Spencer Turner, the nurseryman, and Samuel Turner, the famous traveller' (Elwes and Henry 1910). [The latter, a captain in the service of the East India Company, visited Tibet on a diplomatic and trade mission in 1783, accompanied by a scientist whose report includes the comment: 'I have not yet been able to find an oak tree' (Turner 1800).] Later, Willdenow (1811) published a fuller version in German, with an illustration of a leafy twig. He states that the tree is young and appears to be susceptible to severe cold, although still maintaining that it comes from Tibet. The Berlin tree was last mentioned by Späth (1906) and by 1936 it was no longer in the garden (Dr Thomas Raus, pers. comm.).

Another important distributor was Rivers' nursery, at Sawbridgeworth in Hertfordshire. Loudon (1838) quotes Mr Rivers junior, whose father recollected the tree being originated by Mr Turner, and who had propagated it extensively, as saying: 'It takes readily by grafting on the common oak, from which, in summer, it can scarcely be distinguished, as its branches and leaves are so similar; but, in winter, its thick, glossy, and strictly evergreen foliage has a fine effect'. Unfortunately, Loudon's own account of Turner's nursery and clones is confusing, with inaccurate dates.

Turner's oaks today

Fine specimens of *Quercus* × *turneri* 'Pseudoturneri' may be seen in many collections, in particular at Kew, and it remains in cultivation. However, there are few traces of the original clone after the middle of the nineteenth century – possibly the lack of a distinguishing clonal name contributed to its decline into obscurity. Elwes and Henry (1910) listed the specimens which they had recorded or heard of during 1906–1908 — six were in England, two in Scotland and one in Ireland. Of these, only two have proved currently traceable. By far the most spectacular, and apparently in good health, is the huge specimen at Whiteknights, in the grounds of the University of Reading. It is said to have been planted around 1800 by the Marquis of Blandford, then owner of the property. Its present height is 15 m, and girth 3.5 m at 135 cm (above graft). The other is at Bayfordbury near Hertford, on the former property of the Clinton Baker family. Estate records confirm that this was planted in 1837. Its life is now almost at an end.

Despite the meagre results of their search for the typical form of Turner's oak, Elwes and Henry admitted that 'it is probable that other trees exist which we have overlooked'. And so it has proved. Two puzzling evergreen oaks in London parks were finally identified as this clone by Allen Coombes in 1998. In 2000 a further specimen was noted in Dublin. These three trees appear to be of similar age. One is on the eastern side of Hyde Park, towards Hyde Park Corner (Figure 1). Nearby is a Lucombe oak of comparable dimensions, which may indicate a planting date, as the *Gardeners' Chronicle* (1865) mentions that a chain of flower-beds, 'alternated with Lucombe oaks', had recently been established in this area.

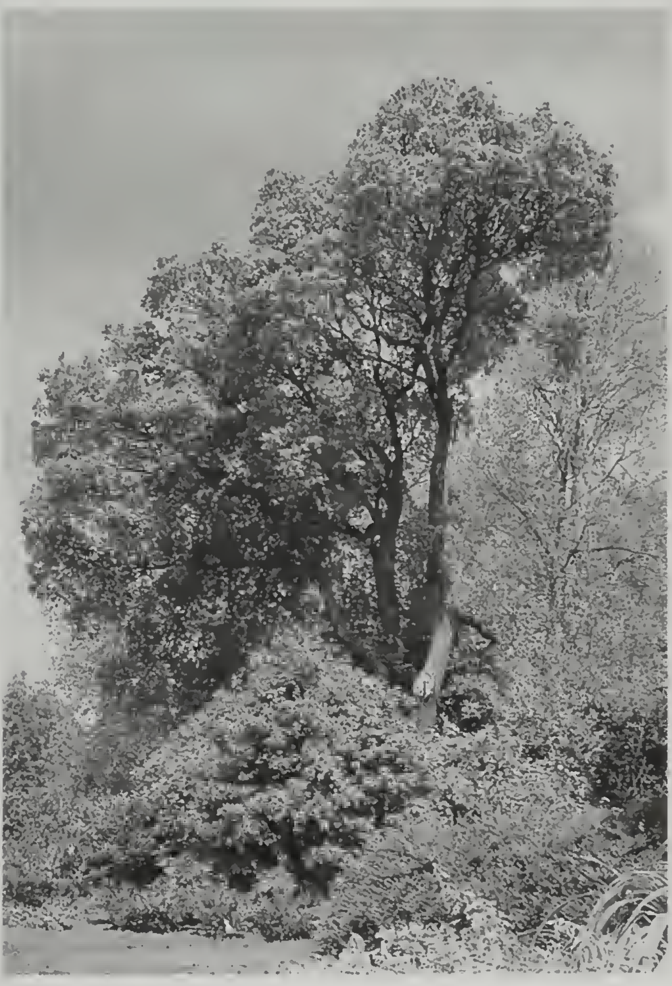

FIGURE 1. *Quercus × turneri* 'Spencer Turner', Hyde Park, June 2001.
Photo: Elinor Wiltshire

The other London tree is in Fulham Palace Park (Figure 2), currently in the allotments area, separated by a hedge from public access. However, an old map indicates that it belongs to this historic collection of choice trees (D. Kennedy, pers. comm.). Only a few metres away stand a magnificent *Juglans nigra* black walnut and a rare *Cladrastis kentukea* (*C. lutea*) yellow-wood. The Dublin tree is situated in the grounds of the National Botanic Gardens, where coincidentally Augustine Henry's notable tree herbarium, including his Turner's oak material, is preserved.

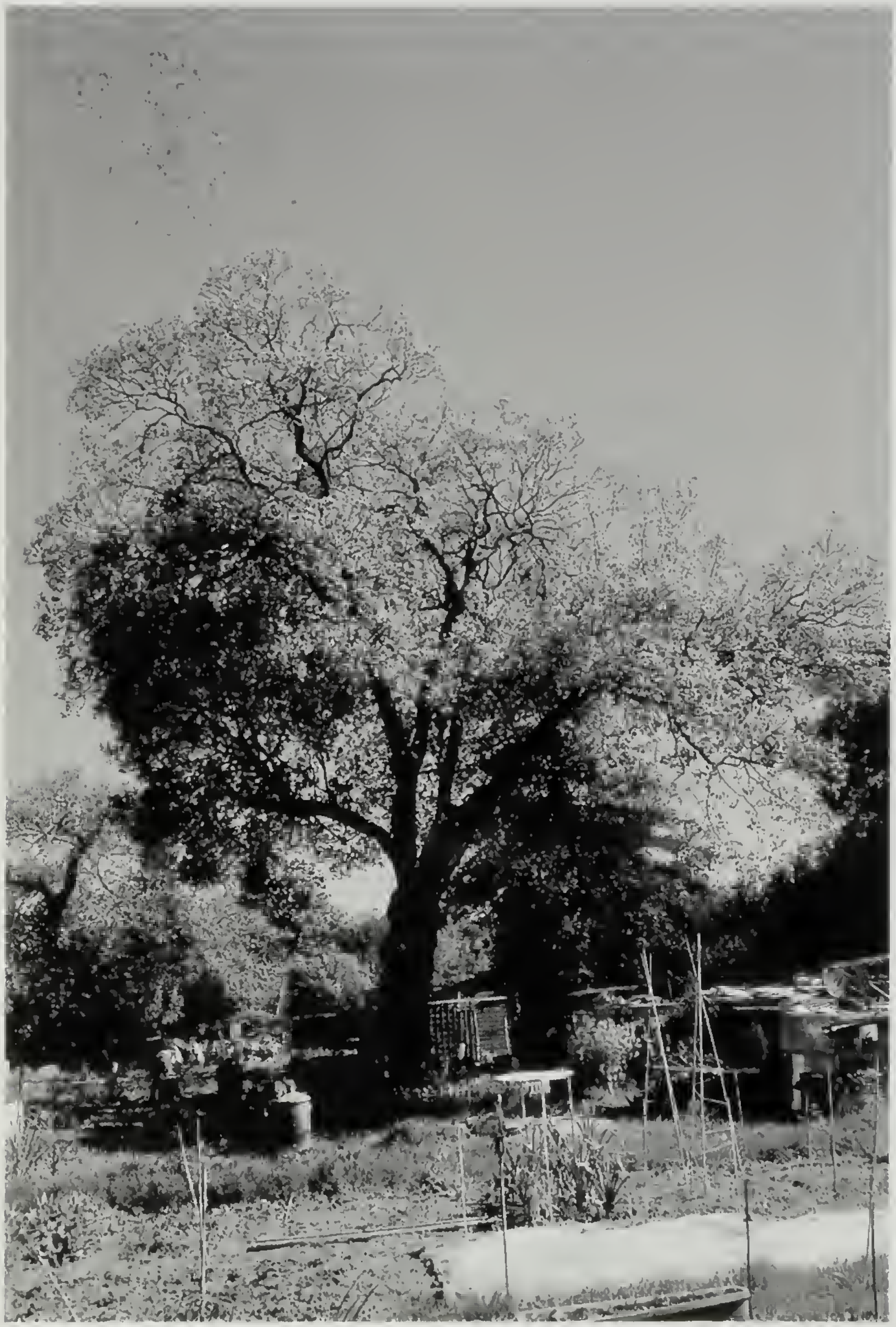

FIGURE 2. *Quercus* × *turneri* 'Spencer Turner', Fulham Palace Park, 29 April 1999.
Photo: Elinor Wiltshire

There is an old tree in Petersham Meadows, Richmond, with similar characteristics to the original form of Turner's oak, except for differences in leaf shape. DNA tests are being carried out on material from this tree, as well as from the others.

There appear to be no examples of this clone in the Royal Botanic Gardens at Kew or in Edinburgh, or in Continental Europe. However, these recent discoveries suggest that there may be more overlooked or unidentified specimens lurking elsewhere in our old parks and gardens. If so, their evergreen winter and spring foliage should attract attention.

Appearance and characteristics of *Quercus × turneri* Willd.

It is difficult to define a characteristic shape for this hybrid since specimens are so scarce and not in good condition. Although much the oldest, the best example appears to be the Whiteknights tree. When measured by Elwes in 1907 it was nearly 16 m in height, with a girth of 2.3 m above the graft. The height is now 15 m and the girth 3.5 m. The Dublin tree is about 17 m tall but with a very unbalanced crown, having lost a large limb at 1–2 m above ground level some years ago. Its spread is 11 m × 13 m and its girth is 2.1 m. Both the London trees have lost major limbs in past storms, although growing fairly well now. However, it is clear that in general the main branches tend to rise at a sharp angle to the trunk, in contrast to Mitchell's description (1988) of 'Low dome, with heavy, low, twisting branches', which refers to *Q.* × *turneri* 'Pseudoturneri'.

The dimensions of the two London trees are as follows:

Hyde Park	height 13.75 m	girth 1.93 m	spread 14 m
Fulham	height 11.5 m	girth 2.29 m	spread 15.8 m

Young shoots are densely pubescent.

Buds are roundish, reddish – sometimes a conspicuous feature, even by late autumn.

Leaves obovate or oval, up to 8 cm long × 4 cm wide; 5–6 forward-pointing shallow teeth on each side; base rounded; glabrous olive-green above, lighter beneath with stellate hairs on midrib and veins; texture firm, with cartilaginous margins.

Foliage remains in place throughout winter and early spring. By mid April, when leaf-fall begins, new foliage is already emerging. By mid May the fresh coverage is almost complete, many leaves having reached their maximum size of about 10 cm although still filmy in texture. They soon become characteristically firm, able to withstand severe weather (they are rarely torn from the tree).

With its graceful open form and fluttering, almost evergreen, leaves, this is an elegant tree, well worth rescuing from extinction. Attempts are now being made to propagate this form and reintroduce it to cultivation.

Description

Quercus × turneri 'Spencer Turner' **new cultivar**

A large, evergreen tree, the leaves persisting until spring when the new foliage emerges. Young shoots densely white-tomentose becoming sparsely hairy or nearly glabrous by the second year. Winter buds rounded, red-brown, the scales covered in white hairs. Leaves (Figure 3) elliptic to obovate, rounded to bluntly pointed at the apex, cuneate to rounded at the base, to 8 cm, occasionally to 10, × 5 cm; veins 6–8 on each side of the midrib, ending in triangular, mucronate, forward-pointing teeth; dark olive green above, paler beneath, with sparse stellate hairs on the veins above, sparsely stellate-hairy beneath at first, glabrous on both sides when mature. Petiole to 1 cm long, white-tomentose when young, becoming glabrous or nearly so when mature. Flowers and fruits not seen.

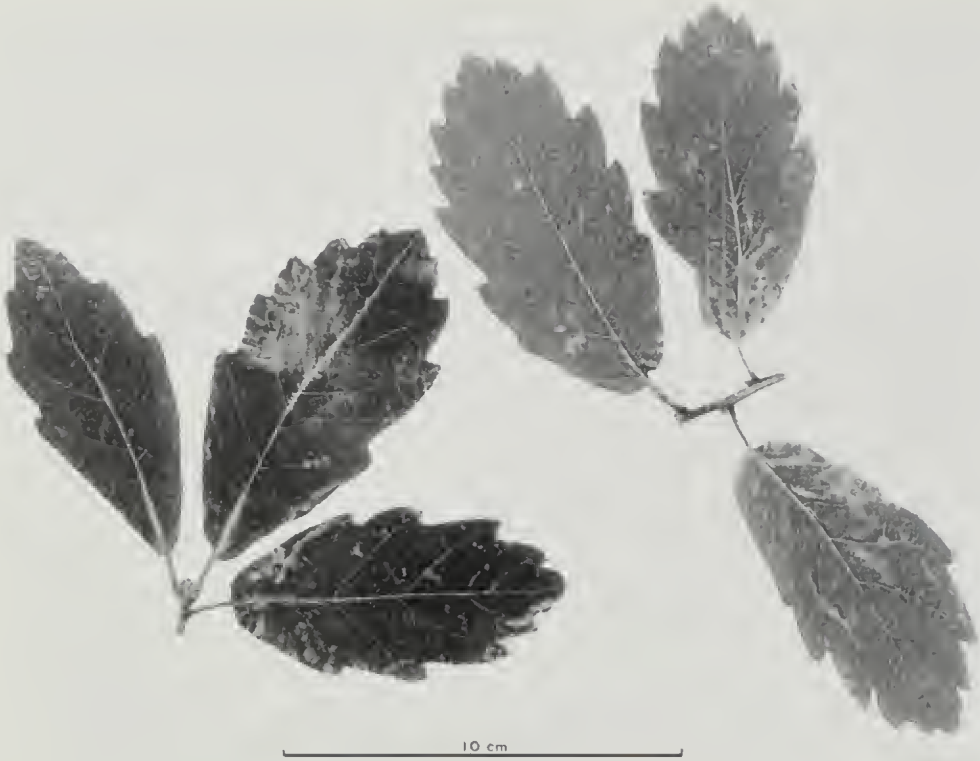

FIGURE 3. *Quercus* × *turneri* 'Spencer Turner'. Typical leaf shapes from tree in Fulham Palace Gardens.

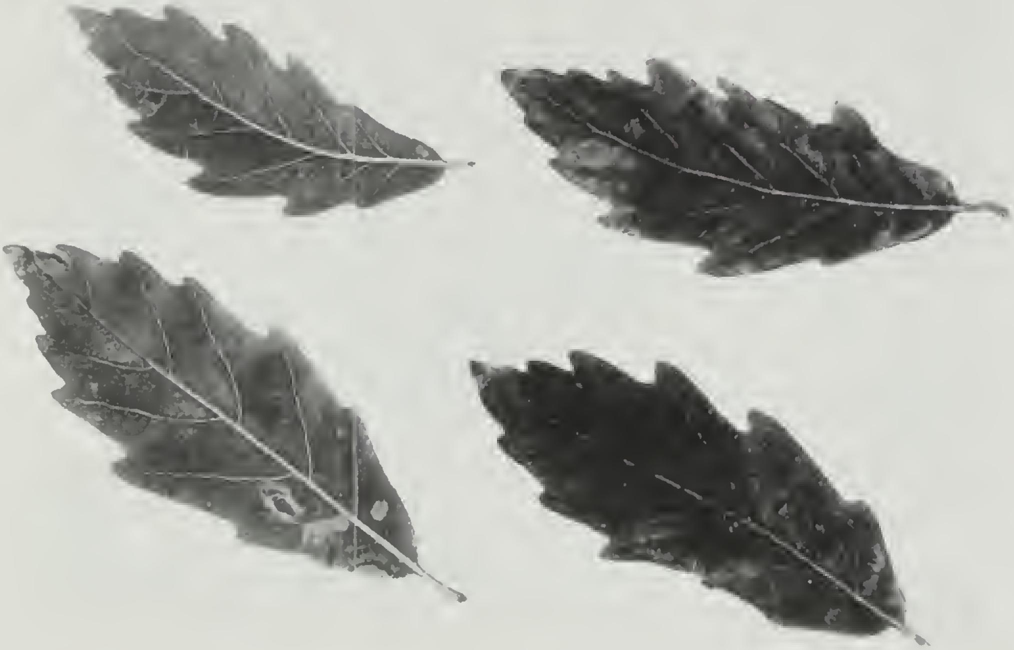

FIGURE 4. *Quercus* × *turneri* 'Pseudoturneri'. Typical leaf shapes. To same scale as Figure 3.

Distinguished from the much more commonly grown 'Pseudoturneri' (Figure 4), which can have leaves to 10 cm or more long, by the shorter and relatively broader leaves with more conspicuously mucronate teeth, blue-green rather than pale green beneath when mature, and the less persistent tomentum on the leaf undersides and shoots.

Standard specimen: Harold Hillier Herbarium. Hyde Park, 17 January 2001.

Acknowledgements

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Brian Mardell, of Walthamstow Local History Library, researched the background of Spencer Turner and his nursery.

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Book review

Unto the hills. The history and wildlife of the South Downs. Patrick Coulcher. The Book Guild Ltd, Lewes. 2001. 250 pp., 77 coloured plates. £19.95, hardback with glossy dust-jacket. ISBN 1 85776 586 9.

I was looking forward to reading this book simply because I very much enjoyed Patrick Coulcher's earlier book on the Cuckmere Valley[1]. Very briefly, this is also a good read with a considerable amount of specific information on species to be seen along and by the South Downs. I could have used this book when I first moved to Sussex.

The author takes us along the South Downs from Beachy Head to St Catherine's Hill near Winchester, describing first the geology and history of the South Downs and then outlining the current natural history of defined and separate areas as part of this east to west journey. My favourite chapters are the early two covering the Cuckmere to the Ouse and then to the Adur, probably because these contain my favourite sites of Mount Caburn and Castle Hill. In addition, I was pleased by the detour to Shoreham Beach, visited before now by the LNHS on botany field excursions.

Maps are provided to cross-reference you to the text. These seem clear to me and the text is unusually precise with reference to many of the rarer plants. I also liked the photographic illustrations, which are a good mix of scenic views, and species that could be seen *en route*.

As to the reliability of the species described, I am not sure if I would expect to see Baird's sandpiper at the little lagoon of Widewater, just beyond Shoreham Beach. However, I suspect the birding rarities, especially raptors, are probably under-represented although the plants and specifically the orchid locations are clearly identified. I have certainly jotted down a few extra strolls for next year. This year the effect of farmland closures raised questions on when this book would be published since the Downs were shut due to foot-and-mouth restrictions. Certainly I was often confused while walking on the Downs this year after the restrictions were lifted as precious few of the £5,000 fine signs seemed to have been taken down. Thus, this book is doubly welcome to start the outings planning for next spring and summer.

The need for good planning controls is stressed in the final chapter due especially to the continual expansion of the seaside towns with their usually small but always destructive encroachments into the Downs. There is a clear subtext in this book that the South Downs are under threat, mainly from planning encroachments but also even from overgrazing on the best nature reserves themselves.

As there are now several good books on the South Downs, how is this one different? This is addressed in the introduction realizing that this book will complement the others and specifically will interest the reader in the history and atmosphere of the South Downs and the interesting places on the periphery.

Considering the many volumes now in print on the Downs the most authoritative is *The South Downs* by Peter Brandon[2] which is an excellent historical survey counteracting the simplistic view of history and specifically agricultural history usually provided. John F. Burton's *Downland wildlife* still provides a good seasonal over-view[3]. The latest work, which provides a good current and historical view of the orchids of Sussex, is by David Lang[4]. Many of the very best and most evocative sites are on the Downs but there is no overlap between these different books.

There is also pleasingly little overlap with the earlier Cuckmere volume and I consider Patrick Coulcher has succeeded in providing a very useful addition to the works on the South Downs well worth acquiring.

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[1] *A natural history of the Cuckmere Valley.* The Book Guild Ltd, 1997. Also the author's book on the Isles of Scilly was reviewed in *LN* **79**, p.20.

[2] *The South Downs* by Peter Brandon, Phillimore & Co., 1998.

[3] *Downland wildlife* by John F. Burton and John Davis, 1992. Reviewed in *LN* **72**, p. 67.

[4] *Wild orchids of Sussex* by David Lang, Pomegranate Press, 2001.

Michael Wilsdon

The history of *Fritillaria meleagris* in Britain to 1900

†DOUGLAS H. KENT

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Editor's preface 29
Introduction 29
The first record — pre 1750 30
The second record — 1762 30
Last quarter of the eighteenth century 31
First quarter of the nineteenth century 32
Second quarter of the nineteenth century 33
Third quarter of the nineteenth century 34
Last quarter of the nineteenth century 36
Early twentieth century 37
Status of *Fritillaria meleagris* L. in Britain 38
References 39
Abbreviations for herbaria consulted 41

Editor's preface

The handwritten manuscript of this paper (not quite finished) was found among the documents and notes of the late Douglas Kent. His long interest in John Blackstone, the eighteenth century botanist/herbalist, who was the first to record fritillaries growing in Britain at Harefield, Middlesex, probably initiated his research into the history of the gradual uncovering of the distribution of Fritillaria meleagris *in Britain.*

The tale is a curious one. Fritillaries are eye-catching and showy when in flower and yet apparently no English botanist or writer of the sixteenth or seventeenth century knew of wild fritillaries in Britain (Grigson 1958). This has led to the suggestion that the species is not native and that British colonies arose from escapes from Tudor or Jacobean gardens. However Druce (1897) pointed out that it occurred in the meadows of the Thames and its tributaries far up the stream in very sequestered country which led him to think that the plant was native.

It seems entirely appropriate to publish this posthumous paper by Douglas Kent in The London Naturalist. *The first two British records of* F. meleagris *came from Middlesex and Duggie was a Middlesex botanist, through and through.*

Introduction

In Britain *Fritillaria meleagris* is a local species chiefly found in moist meadows, and a map (Perring and Walters 1962) showing its distribution reveals that its main concentration is near the upper Thames in Gloucestershire, Wiltshire, Oxfordshire and Berkshire, where it is locally plentiful, though apparently decreasing, in water meadows. From here the range of the plant extends northwards to the Midlands (chiefly Warwickshire, Staffordshire and Leicestershire), southwards to Hampshire and Dorset, and eastwards to the Home Counties (chiefly Hertfordshire and Middlesex) and Suffolk and Norfolk. In south-western and northern England and Wales the species has been reported as a naturalised garden escape.

No reference to *Fritillaria meleagris* appears in the works of William Turner (*c.* 1508–1568), Matthias de Lobel (1538–1616) or Pierre Pena (*c.* 1530–1605), and the species was apparently unknown to them. John Gerarde appears to be the first British author to comment upon the plant, and in his *Herbal* (1597) he wrote 'These rare and beautiful plants grow naturally wild in the fields about Orleance and Lions in Fraunce, from whence they have been brought into the most parts of Europe. The curious and painful Herbarist of Paris John Robin, hath sent me many plants thereof for my garden where they prosper as in their own native countrey'. Parkinson (1629) adds further data on the plant — '. . . first brought to our knowledge from France, where it groweth plentifully about Orleance . . . Some call it *Narcissus Caparonius*, of the name of the first inventor or finder thereof, called Noel Caperon, an Apothecary dwelling in Orleance at the time he first found it, and was shortly after the find thereof taken away in the Massacre in France . . .'. The discovery of the species by Caperon is recorded by L'Escluse (1583/4) who states that the finder noted it growing abundantly in meadows by the Loire at Orleans in 1572 and sent him a specimen. Parkinson's final sentence refers to the death of Caperon during the massacre of the Huguenots on St Bartholomew's night, 25 August 1572. That *F. meleagris* was in cultivation in a number of the small botanic gardens maintained by apothecaries in the late sixteenth – early seventeenth centuries is confirmed by Gunther (1922) who cites at least three such gardens in which it was present.

The first record — pre 1750

The earliest recorded occurrence of the species as a 'wild' plant in Britain is to be found in a letter written on 11 December 1736 by John Blackstone, a London apothecary, to Sir Richard Richardson, the eminent Yorkshire botanist and antiquary. In this letter Blackstone stated that '*Fritillaria praecox, purpurea, variegata* . . . grows in a meadow by a woodside near Harefield, and has done so about forty years, as a neighbouring gentleman informs me'. In his *Fasciculus Plantarum* Blackstone (1737) gives more precise details of the locality (see Frontispiece), and reveals that the original recorder was his maternal grandfather, Francis Ashby. This Middlesex station was rediscovered about 1780 by John Lightfoot whose manuscript note reads — '*Fritillaria meleagris* . . . in a small meadow going from Uxbridge Common to Ruislip Common . . . on the right hand a little beyond a farm called Blackenburgh in Harefield parish'. No later record is known from this locality of which a fuller account is given by Kent (1969). [*Lightfoot's site description better fits fields near the River Pinn, more than a mile to the south of Blackstone's station in Maude-fields, adjacent to Bayhurst Wood. Fritillaries were reintroduced to Blackstone's site in 1990. In 1998 sixty to seventy flowering plants were counted. C.B.*]

The second record — 1762

The second British record *In pratis inter Mortlake et Kew* was given by Hudson (1762). This Surrey station soon became well known and the large number of specimens from there in the national herbaria suggest that it was visited annually by botanists. Towards the middle of the nineteenth century the plant was thought to have become scarce, and Edwards (1843) wrote 'This species, called by the country folk "Snakes-head", used to flower in a meadow at Mortlake, Surrey, known from that circumstance as the Snakes-head Meadow, but of late years it has become very scarce, if not altogether eradicated by the ruthless hands of the village children, by whom the showy plant was coveted as an ornament to their May garlands. This meadow is by the Thames side, beyond the brewhouses, about midway between the village and Kew Bridge. On visiting the spot at the proper time, during several seasons within the last five years, I was not able to obtain more than a single specimen'. This produced a somewhat critical note from Ross (1843) who wrote 'It may be interesting to some of your readers, especially Mr Edwards (*Phytologist* 1843), to know that this pretty plant and early ornament of our meadows, produced its drooping flowers in abundance last April, in the locality mentioned by Mr E . . .; but I am sorry to say that too many of the radical botanists visited the station during the time it was in flower; such hands prove more destructive than the Mortlake children, even supposing they do pull off the flowers to ornament their May-garlands'. That Ross's comments were well justified is confirmed by Penfold (1862) who wrote '. . . not yet extinct in the Mortlake locality. When out with the Rev. W.W.N. (= Newbould) on May 8th last, two fine plants were gathered by a rustic with us, who gave them to Mr N., from whom I have one. There did not seem to be any more in the field'. Salmon (1931) suggests that the species survived in its metropolitan locality up to about 1876.

Last quarter of the eighteenth century

The third British station 'About half-a-mile from Laxfield towards Stirrup Street, in a wet meadow in Scare Fen, in great abundance, and in several other pastures within five miles of that spot' was found by J. Crowe in 1776. This East Suffolk record was confirmed by Woodward in 1824 (Smith 1824). The publication of the second edition of Hudson's (1778) *Flora Anglica* provided additional records — 'near Bury, West Suffolk', found by Sir T.G. Cullum, and where it survived until the mid nineteenth century if not later, and 'near Enfield, Middlesex'. This was confirmed by Withering (1787) but has not been recorded from the district since.

The year 1781 was notable for the discovery of *F. meleagris* in four new sites in the Home Counties. Curtis (1781) wrote '. . . this spring I received information that it was found wild in a wood belonging to Mrs Wilson at Bromley, Kent'. The habitat was an unusual one for the species and the record has never been confirmed. John Lightfoot found two new stations in Middlesex — 'In a meadow near Swakeley in Ickenham parish, and between Swakeley and Long Lane, abundantly'. At Swakeleys Park it persisted until the early twentieth century (cf. Kent 1969). The fourth locality was in Buckinghamshire, and Lightfoot was again the finder, his manuscript note reads 'In a solitary meadow about half-a-mile from Iver, south-west of the village on the right hand going from Iver to Thorney'. Here the plant persisted until at least the middle of the nineteenth century.

In 1785 the indefatigable Lightfoot added yet another new locality, and one that is perhaps now the best known of all British stations — 'Magdalen College Meadows'. This was the first indication of the occurrence of *F. meleagris* in the Oxford area where a century later it had become so plentiful that Druce (1886) was able to write 'One year Mr Baker informs me, Prof. Lawson sent to Kew 3,000 specimens for use at the Science and Arts Examination at South Kensington'. Druce (1927) further comments that 'the wanton way in which the plant is gathered [in the Oxford area] threatens its destruction in the not distant future', while Turrill (1952) describes the rapid decline of populations in the area where the public have access while the colonies in Magdalen Meadows, where it was protected, continued to thrive. The species happily still survives in great abundance in Magdalen Meadows and Turrill (1952) describes a study made on colour variation in the perianths of a population of many thousands of plants there in April 1941. By a strange coincidence the year 1785 also produced the only published record for Cambridgeshire — 'In some closes at Westhoe near Linton' (Relhan 1785). The record has never been confirmed.

The presence of *F. meleagris* in the Midlands was established by S. Dickenson, who in 1787 discovered it 'in a meadow near Blymhill . . . plentifully' (Withering 1787). Further data on this Staffordshire station was provided by Dickenson (in Pitt 1794), where it is stated that 'This curious and rare flower adorns in great profusion some meadows about a mile from Blymhill, in the parish of Wheaton Aston.' The species was still present, though very rare, in the locality as recently as 1949, and Edees (1950) wrote 'On April 30th 1949, our member Mr T. Smith accompanied me to the field where he used to gather it as a boy. On this occasion our search was unavailing. A week later on May 7th, I was redirected to the same series of fields by Mr E. H. Hatton, the village schoolmaster, who supplied me with a guide. Nine blooms were seen (all purple). It has long been the custom at Wheaton Aston for the village children to go out on the first Sunday in May to gather the "Falfallarias" as they call the flowers. The result is that the species is now on the verge of extinction, its present frequency being *c*.3 plants per acre'.

Charles Abbot (1798) recorded the plant from moist meadows at Bromham, Bedfordshire, and prior to 1799 Pulteney had heard that it grew in Dorsetshire. He writes (Pulteney 1813) 'I have been informed on what I considered good authority that this plant grows in a wood on the left hand between Fiddleford and Sturminster Newton'. Neither Abbot's nor Pulteney's records were confirmed.

The first Berkshire record 'near Reading' was contributed by Murray in Smith (1799) and by the middle of the nineteenth century the species was known to be locally abundant in a number of stations, chiefly near the Thames, in the vice-county. A second Midland locality — 'Leicester, Dr Arnold' was recorded by Withering (1801). Four years later T. Arnold's station appeared in Turner and Dillwyn (1805) as 'near Leicester'. The locality in which the plant grew was in fact by the River Soar at Thurmaston, and in 1914 a County Council Order was obtained in order to secure its protection (Horwood and Gainsborough 1933). The plant survives there today.

First quarter of the nineteenth century

In 1802 A.B. Lambert gathered specimens in 'Lord River's Park, Strathfieldsay, growing in great abundance'. This station near Basingstoke in North Hampshire is well represented by specimens in the national herbaria indicating visits to the area by generations of botanists. Turner and Dillwyn (1805) cite J. Woods as the discoverer of the station, and Bromfield (1850) credits the record to Miss E. Sibley. He writes 'In all the woods around Strathfieldsaye (the Duke of Wellington's), on the northern limit of the county, but in more abundance in the Park . . . Here the fritillary grows in tens of thousands in the wet pasture and meadow land, scattered over a vast acreage of the park . . .'. Vaughan (1920) refers to it as being abundant on both sides of the Loddon, and to the fact that quantities were gathered annually and sold for the benefit of local charity. By 1953 it had apparently decreased considerably for a sheet bearing a specimen collected by A.H.G. Alston (**BM**) is endorsed 'Field W. of End Mill, Stratfield Saye, in quantity in one field only'.

Turner and Dillwyn's *Botanist's guide* published in 1805 repeated the details of most of the older localities but contained also some new ones — 'Totteridge, Middlesex' (probably Hertfordshire), another well known station where it was gathered as recently as 1944. Specimens collected by H. Trimen in 1863 (**BM** and **K**) are labelled 'In vast plenty in Sir E. Bulmer-Lytton's grounds, Totteridge'. 'In a peatfield near Dorney, Bucks.', a locality which has never been confirmed. H. Tilney's record 'In a field called seven acres, by the side of Mendham long lane, near Harleston'. Galpin (1888) refers to it as having grown in the Harleston district of East Norfolk from time immemorial, although it is now regrettably extinct there. Lastly there was the second station for Staffordshire — 'In great abundance on the right hand side of the road from Wolsely Bridge to Stafford'. This population which consisted entirely of white-flowered plants was rediscovered by H.P. Reader in 1919 (Reader 1920).

A second metropolitan habitat for the species was located in 1815 by Edward Forster (1815) who gathered specimens 'In the marshes near Lea Bridge near the path to Marsh Street, Walthamstow' (**BM**). The plant survived in this South Essex station until 1884, if not later. In the same year J. Sabine (Sabine 1815) recorded it from two additional Hertfordshire localities — Northaw and near Bushey Heath. Neither of these stations was ever confirmed though the former is within the range of known localities at Barnet and Potters Bar.

Another Midland locality was added by Perry (1817), who reported the species from 'Wroxall Field, Warwickshire'. Here it survived until 1866 or later. In 1819 it was collected at Ashby St Ledgers, Northamptonshire (**BM**) (cf. Baker 1822), and during 1825 J. G. Perry received specimens gathered at Godfrey's Lammas, Warwick (Bagnall 1891). No further information is available on either of these stations.

Second quarter of the nineteenth century

In 1829 J. Rutter discovered the plant at Compton Martin, North Somerset (Rutter 1829). Here it survived for many years, and White (1912) provides the following information. 'Formerly abundant in a field, or fields close to the village of Compton Martin, where it is said to have grown "for ages", and was recorded by Collins in1836. Subsequently a former proprietor of the land, annoyed by "people coming from miles and miles around to gather the flowers" (as was revealed by a very old inhabitant of the place), did his best to have the plant grubbed up, with the result that for a while it appeared to have been extirpated and could not be found by my friends or myself in the early eighties. In1884, however, Mr Lovell, a surgeon of Compton Martin, forwarded specimens to Mr T. B. Flower, and in 1887 Messrs. Fry and Sherring found twenty-one in flower of which fourteen were white and seven red'. Specimens gathered by Fry and White are at the British Museum (Natural History), London. These provide the last evidence of the presence of the plant in the locality. During the same year J. S. Henslow found it growing in quantity in meadows at Mickfield, East Suffolk. The species still survives here in abundance in one small meadow where it is protected (Simpson 1966), and the population was made the subject of a detailed ecological survey by Trist (1961).

The occurrence of *F. meleagris* in northern England was revealed in 1830 when it was found growing sparingly in meadows between Tadcaster and Newton Kyme, Mid-West Yorkshire (Baines 1840). Baines was not responsible for the record and treated it with some caution. It was, however, confirmed in 1856 by J. D. Heaton who gathered specimens in a 'Wharfeside pasture above Tadcaster, towards Benards Hal' (**BM**). Further evidence was provided by Lees (1888), who wrote 'In the Ings pastures by the Wharfe below Tadcaster, solitarily and very sparingly, but with Gagea'. There does not appear to be a twentieth-century record from the area.

In south-east England the first record for West Sussex — 'Meadows north of the church, Hurstpierpoint' was made by W. Borrer (Cooper 1834), but the plant apparently failed to persist as Hemsley (1868) wrote 'said to have been found in a meadow north of the church at Hurstpierpoint but it has not been found there of late nor in any other part of the county'. Borrer, it may be added, considered the species to be an introduction. During 1836 it was gathered at Framsden, East Suffolk by H. Kirby (**DBN** and **EDINB**). This station is also represented up to recent times by specimens in the national herbaria, and survives in quantity in the meadows where it is now protected (Simpson 1966). The ecological study by Trist (1961) also covered this population and interesting comparisons are made between it and the population at Mickfield. About 1837 it was noted in meadows near Uttoxeter, Staffordshire by G. Howitt (Watson 1837), and in 1839 was gathered at Hoddesdon Marsh, Hertfordshire by W. H. Coleman (**K**) and from the same locality in 1841 by P. Warner (**K**). No further information is available on these two stations.

Leighton (1840) refers to the species as being 'naturalised by J. F. E. Dovaston Esq. in the fields near Westfelton, Shropshire.' Whether or not this attempt to naturalise the plant was successful is not known. In the following year Flower (1841) reported it 'in meadows at Bitton, West Gloucestershire, but seldom flowering'. The station was confirmed by St Brody in 1863 but White (1887) recorded that it had become extinct. About 1841 also, it was reported from near Broomfield, North Essex by M. Clayton (Gibson 1862). The record was not confirmed.

In 1842 J. A. Hankey gathered specimens at Finchley, Middlesex (**BM**), and in the Proceedings of the Linnean Society of London vol.1, p.134 (1842) appears the following note 'J. A. Hankey, Esq., F.L.S., laid on the table for distribution numerous specimens of *Fritillaria meleagris*, gathered by himself at Finchley, 5th May 1842'. Hankey's material probably came from the Totteridge side of Finchley, and a specimen labelled 'Near Totteridge, Middlesex, 1890' collected by W.W. Reeves (**BM**) may be a confirmation of this station. The plant is now extinct in the area. Prior to 1844 *F. meleagris* was reported from Alstone Lawn, Cheltenham, East Gloucestershire, by J. J. Buckman (Riddelsdell et al. 1948). The station was not confirmed.

The second station in northern England — Sandbeck Park, South-West Yorkshire was found by G. E. Smith about 1845 (Lees 1888); in 1884 it was still present in the open turf, and abundant in places (Lees 1888). Specimens collected in 1884 by J. Backhouse Junr., are at the Royal Botanic Garden, Edinburgh, and by F. A. Lees, at the British Museum (Natural History), London. The continued existence of the plant in this station is confirmed by Dallman.

Before 1847 the species had been detected in South Hampshire by L. Minchin. Bromfield (1847) gives the following data supplied by Minchin '. . . growing plentifully in a moist meadow adjoining the Winchester Road, just before entering Bishop's Waltham, where it has been known for many years past, ingress now I understand denied by the owner Mr Jonas, in consequence of the injury done to the land by persons digging up the bulbs for transplanting to their gardens, and from a laudable desire to preserve the plant from extirpation'. The plant was still present in 1877 (Townsend 1883) but has not been recorded since. A specimen dated 1847 and gathered by Jonas is in the Herb. Hooker at Kew (**K**).

The publication of Webb and Coleman's *Flora Hertfordiensis* in 1849 produced a number of new records for the vice-county — 'Spring Mead, Great Munden Old Rectory', a station which is now lost: 'In a pasture . . . between Barnet and Hatfield, where it varies with white flowers'. A record from 'meadows near Barnet' made in 1953 by I. G. Lansbury (Kent and Lousley 1955) may be a confirmation of this station. 'In a moist pasture near the railway arches Watford' (Betts), and 'St Albans' (Henslow 1887). The former station remains unconfirmed, but in the latter the plant was seen by Pryor (1887), though it is presumably now extinct.

Third quarter of the nineteenth century

During 1850 it was gathered at Harpenden, Hertfordshire by G. C. Churchill (**BM**). This was the first reference to the well-known station at Rothamstead Park where the plant is still to be found (Dony 1967). It was in this year also that R. Holland gathered a specimen from the now famous Oaksey population. Holland's specimen (**BM**) is merely labelled 'Meadows near Minety, April, 1850'. The first published notice of this North Wiltshire station appears to be that of Newman (1852) where he describes a new locality — meadows adjoining Oaksey Park, Wilts., two miles from the Kemble Station, on the Great Western Railway — occurring abundantly over one hundred and twenty acres of meadow. The station was then, as even today, somewhat remote and T.B. Flower in a letter written to H.C. Watson in late April 1862 wrote 'I was on Monday (April 28 1862) in the neighbourhood of Oaksey near Minety Station, Wilts., where I found fields of *Fritillaria*; the meadows being quite purple with it . . . I should imagine it extended over an area of at least 60 acres'. Later, (Flower 1872) he published a short note — 'Abundantly at Oaksey, where it occurs over one hundred and twenty acres of meadow. One piece of sixteen acres was entirely covered with this plant'. Today the species, locally known as the 'Oaksey Lily', still occurs in great quantity despite the fact that vast numbers of the flowers are gathered annually by the local inhabitants and others, and the statement made by Grose (1957) that 'It is probably more abundant at Oaksey than anywhere else in the country' is undoubtedly correct.

During 1854 the species was discovered by W.C. Unwin in a plantation near Ringmer Green, East Sussex, but the record remained unconfirmed (Wolley-Dod 1937), and in 1857 it was found near Higham, West Kent (Pratt 1857), but the plant is now extinct in the area. Prior to 1859 the plant was gathered at Winterbourne, West Gloucester by Stephen (**EDINB**). This habitat was, however, destroyed by ploughing in 1859.

Three additional records for the north of England — all South Lancaster — appeared in 1859. Buxton (1859) reported the plant from a 'Field at Moss-side', and J. Percival noted two other stations — 'In a field near the river Bollin, below Cotterill' (Grindon 1859) and 'In meadows near Ratcliffe, plentifully every spring' (Grindon 1859). So far as I'm aware none of these stations has been confirmed. In 1860 C. J. Ashfield noted the species in a 'meadow near Stainhall' (Ashfield 1861). This was confirmed by Pearson (1874) who wrote 'A meadow at Stainall, North Lancashire, assumes in April a dusky brown hue from an abundance of the plant *Fritillaria meleagris* . . . '. During the same year *F. meleagris* was gathered near Cricklade, North Wiltshire by Mrs Torrance (**BM**). It still survives in the area.

Two more celebrated stations, Pinner, Middlesex and Ford, Buckinghamshire, were recorded in 1861. Hind (1861) reported that the plant was growing in 'Fields at Pinner in one of which it is very abundant'. Trimen and Dyer (1869) give further data based on information from Hind '. . . this field is a little north of the church, and adjacent to Moss Lane. The plant occurs in three other meadows near and also an orchard'. The numerous specimens dating from 1866 to 1914, in the national herbaria provide evidence of the continuance of the population, and of the many eminent botanists who visited the area. In the 1920s the fields were levelled and built on, and Druett (1937) stated 'now extinct at Pinner'. During 1950 T.G. Collett rediscovered the species in an old orchard at Moss Lane (Lousley 1951). This was undoubtedly one of Hind's original localities. During 1964 the orchard was grubbed up and the area levelled and built over (Kent 1969). Ashfield (1861) referred to the species as being very plentiful in fields on a farm called Waldridge, near the hamlet of Ford, in the parish of Dinton. He mentioned also that the plant was well known to the local residents as far afield as Aylesbury. 'B'(1866) gave additional information on the habitat, viz. 'This rare plant is exceedingly abundant near a little place named Ford, at Dinton, near Aylesbury. In 1865 I observed it there, extending over six or seven meadows where it presented a beautiful appearance. I learned from an inhabitant that persons came from "all-round" to gather it when in perfection, and the meadows bear the name of "Crowcup", or "Frowcup" (query Frog-cup?) Fields . . .'. As in the case of the Pinner station there are many specimens, in this instance dating from 1865 to 1944, in the national herbaria. Regrettably this well documented station was largely destroyed by ploughing in 1950. During the same year Winter (1861) reported that the species was 'occasionally seen in meadows at Burgh St Peters, East Norfolk'. This record was never confirmed.

Gibson (1862) gives a further locality for North Essex — 'Formerly abundant in a meadow at Bumpstead; but now almost eradicated from being taken up for gardens'. The plant is now extinct in the area. E. G. Varenne (1864) noted *F. meleagris* in a 'Pasture at Gt. Warley', twelve years later Blanche (1876) wrote '. . . found by me five years ago in large quantities in the woods surrounding Warley Lodge, Brentwood, Essex'. It was again seen in 1924 — 'Between Little Warley Church and Great Warley' on the occasion of the Essex Field Club Excursion (*Essex Nat.* **21**: 84, 1924), and was apparently last seen in the area *c.*1955–56 by Mrs G. A. Griffiths (teste S. T. Jermyn). About 1866 it was discovered growing abundantly on an island in the Tame at Tamworth, Staffordshire ('A.M.D.' 1866) and was again found in the area by Ede Hamel in 1879 (Bagnall 1891). Still present in 1958 — see Edees (1960). About 1866 C. B. Clarke (Clarke 1866) recorded the plant from Weyhill, South Hampshire, a station which was never confirmed, and in 1866 D. C. Timmins reported that he had found it on 'chalk hills near Wrotham' (Timmins 1866), this rather unusual West Kent habitat was confirmed by C.W. Shepherd about 1883 (Ewing 1883). It has not been recorded from the district since. Prior to 1869, a single plant was noted at Colney Hatch, Middlesex by A. H. Church (Trimen and Dyer 1869). The record remained unconfirmed. During 1870 H.F. Parsons gathered the plant at Norton St Philip, North Somerset (**MANCH**); a sheet containing a further specimen, collected by Parsons in 1873 (**BM**) is endorsed 'Near Norton St Philip, in a field on north of Farleigh Road . . . said by old inhabitants to have been formerly abundant there, but dug up by gardeners from Bath until now but a single plant remains'. A third specimen from the station gathered by Parsons in 1874 (**MANCH**) bears the legend 'nearly extinct, only 1 plant now'. The species, however, did apparently linger for a few more years for T. B. Flower (Murray 1896) noted 'In a field near Norton St Philip, seldom flowering'. It seems probable that it became extinct by the end of the nineteenth century.

The first record for South Wiltshire – 'Meadows near Stert' — was provided by Flower (1872), and Grose (1957) suggests that a much later record — 'Water meadows three or four miles from Bishop's Cannings' (Gandy 1929) — is probably a confirmation of Flower's station. During 1873 the species was collected at Potters Bar, Middlesex by H. and J. Groves (**BM**). A record for South Mimms (Brittain 1931) is possibly a confirmation of the station. A new Dorsetshire locality — 'In Common-mead fields and elsewhere near Gillingham' — was provided by Salter (Mansell-Pleydell 1874). Here it apparently survived until the end of the nineteenth century if not later. Powell (1892) gives further information on the plant in South Essex — 'In 1875 this was found near Theydon by my friend Mr E. Lindel. On searching with him a season or two afterwards I could not find a single specimen. He subsequently learned that it had been dug up. This may illustrate the destruction of rare plants which goes on'.

Last quarter of the nineteenth century

During 1877 *F. meleagris* was recorded from Ilam, Staffordshire (Edwardes 1877), and in 1882 from Denstone in the same vice-county (Goodall 1882). Neither station was ever confirmed. In the years immediately following it was recorded from two additional Dorsetshire localities — 'Buckland Newton' (Dale 1878) and 'Moist meadows' Pulham (1879). Nothing further is known of either station. The first record from Worcestershire was published when F. J. Eld (1885) noted 'two specimens in a meadow near Warndon'. These plants were apparently casual garden escapes and did not persist in the locality. During the same year A. Bloxam recorded the species 'In a meadow on the right-hand side of the road beyond Troutbeck to Ambleside' (Bloxam 1885). This was the first and only evidence of the occurrence of *F. meleagris* in Westmorland, and Wilson (1938) considered that it was probably planted. In 1886 it was discovered at Flamborough Head, East Yorkshire on the occasion of a Yorkshire Naturalists' Union field meeting, and it seems likely that it had either been planted or was a garden escape as there is no evidence of it having survived there. During 1887 it was gathered in the Cirencester neighbourhood by C. B. Clarke (**DBN** and **K**) but there does not appear to be a later record from the area. Preston's (1888) publication provided details of a number of new stations in the county — for North Wiltshire — Malmesbury, Hilmorton, Bradford Wood, Latton and Inglesham. The Latton station was confirmed by Grose (1957), the remainder have apparently become defunct. New stations for South Wiltshire were Erlestoke and Devizes. Neither was confirmed. In the same year Galpin (1888) provided information on additional stations in East Norfolk — 'Meadows at Luck's Mill, Needham' — where it was found by W. R. Cordell, and Metfield. Nothing more is known of these. The appearance of W. M. Hind's (1889) flora provided data on various new localities for the species for East Suffolk — St Margaret's, St Cross, Gipping to Debenham, Wickham Skeith, Warlingworth, Bramford, Ashbocking, and Bergholt — all now apparently defunct, and for West Suffolk — Tostock and Woolpit. Nothing further is known of either of these stations. A new locality in North Somerset was found in 1891, of which White (1912) wrote 'In two fields west of Barrow Gurney; rather plentiful in a portion of one, and sparingly in the other. This locality which was brought to my notice in 1891 by Mrs Alfred Britton and Prof. Leipner has become known to many and the flowers are freely gathered. Still the plant holds on well and seems none the worse for the periodical loss of their mottled bells. As is usual a few white flowers hang their heads among those of a rosy purple. The total number at this station is at most between fifty and sixty'. Specimens from here were gathered by H.W. Pugsley in 1936 (**BM**) and it is possible that the station survives. A new station for East Gloucestershire 'In abundance . . . at Oakly, where the steeple chases are sometimes held' was given by H. J. Elwes (Witchell and Strugnell 1892), but confirmation is lacking. In 1894 it was found near Northampton by Burgess and Dixon (1894), but no further record from that vicinity is known. During 1895 it was discovered at Alvechurch, near Redditch, Worcestershire by Prof. Poynting (Matthews 1895), and in the same year was recorded from a 'water meadow, Chetnole', Dorsetshire, where it was found by W. M. Rogers (Mansell-Pleydell 1895). No further information is available on either locality. Two years later it was discovered in 'a meadow near Eaton Bray', Bedfordshire by R. A. Chambers (Hamson 1906), where it is now extinct. During 1898 it was collected at Mottisfont, South Hampshire by R. Meinertzhagen (**BM**) and was noted in Cumberland 'As a waif from cultivation . . . in the grounds of Old Church, on the margin of Ullswater, by . . . Issac Herd, gardener there . . .' (Hodgson 1898), while in 1899 it was recorded from Upnor, West Kent by Miss Young (Hanbury and Marshall 1899). It is now doubtless extinct in all these localities.

Early twentieth century

In 1900 a new Worcestershire station, Tardebigge, was found by J. Humphreys (Rea 1901). In 1901 it was recorded in a water meadow at Old Woking, Surrey (Biddiscombe 1901), and in 1902 it was reported 'In a meadow at Chipping Sodbury', West Gloucestershire by Miss Neale (White 1912) and from Riccall, East Yorkshire (Robinson 1902), while in 1904 it was recorded from a new locality in South Hampshire — '. . . fields near the Priory at Beech Hill, abundantly' by Mrs Joyce (Townsend 1904) and from Frenchay, West Gloucestershire (White 1912). In all these stations it is now presumably extinct.

During 1906 it was gathered at Weston-Super-Mare, North Somerset by G.V.C. Last (**K**)

The manuscript stops at this point. Duggie Kent had collected later twentieth century records but it would be a presumption to attempt to complete his paper using them. In any case these later records become increasingly likely to be naturalized plants. It has been thought better to round off Duggie's account of the history of fritillaries in Britain with the final paragraph from a paper he wrote for the Journal of the Ruislip and District Natural History Society *(Kent 1969) entitled* 'Fritillaria meleagris *L. in North West Middlesex' (where they were first recorded):*

'That *F. meleagris* was at one time locally abundant in various areas of north-west Middlesex (and in the north-east) is certain. The status of the species, however, must remain a vexed problem. One has only to note the abundance of *Lepidium latifolium*, a species of coastal salt marshes, and of the North American adventive *Impatiens capensis*, the introduction and spread of which are fortunately well documented. Had these plants been introduced prior to the sixteenth century their present status might be equally as puzzling as that of *F. meleagris*. For my part I am tempted to agree with Grigson (1958) that the fritillary is an early introduction now thoroughly naturalized in England, with a status similar to that of *Ornithogalum umbellatum* and *Tulipa sylvestris*.'

Status of *Fritillaria meleagris* L. in Britain

V.c.	Status	Last record
[2]	No localised record	
[3]	Naturalised garden escape	
[4]	Naturalised garden escape	
6	Native?	pre 1930
7	Native?	post 1930
8	Native?	pre 1930
9	Denizen or naturalised garden escape	pre 1930
11	Native?	pre 1930
12	Native?	post 1930
13	Native?	post 1930
[14]	Naturalised garden escape	
16	Denizen or native?	post 1930
17	Denizen or native?	post 1930
18	Native?	pre 1930
19	Native?	pre 1930
20	Denizen	post 1930
21	Denizen or native?	post 1930
22	Native?	post 1930
23	Native?	post 1930
24	Native?	post 1930
25	Native?	post 1930
26	Native?	pre 1930
27	Native?	pre 1930
[28]	No localised record, or naturalised garden escape	
29	Native? or naturalised garden escape	pre 1930
30	Native?	post 1930
31	Native? or naturalised garden escape	post 1930
32	Native?	pre 1930
33	Native?	pre 1930
34	Native?	post 1930?
36	Naturalised garden escape?	post 1930
37	Denizen or naturalised garden escape?	pre 1930
38	Denizen or naturalised garden escape?	pre 1930
39	Denizen or naturalised garden escape?	post 1930
40	Naturalised garden escape	pre 1930
50	Naturalised garden escape	post 1930
[53]	No localised record	
[54]	No localised record	
55	Native? or denizen?	post 1930
59	Naturalised garden escape	pre 1930
60	Naturalised garden escape	pre 1930
61	Naturalised garden escape	post 1930
[62]	No localised record	

63	Denizen or naturalised garden escape	post 1930
64	Naturalised garden escape	pre 1930
69	Naturalised garden escape	pre 1930
70	Naturalised garden escape	pre 1930
71	Naturalised garden escape	post 1930
[75]	No localised record	

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BM	British Museum (Natural History), London.
DBN	National Museum of Ireland, Dublin.
EDINB	Royal Botanic Garden, Edinburgh.
K	Royal Botanic Gardens, Kew, Surrey.
MANCH	Manchester Museum, University of Manchester.

Book review

A guide to the identification of deciduous broad-leaved trees and shrubs in winter. Andrew May and Jonathan Panter. Field Studies Council. 2000. 53 pp., A4, paperback. ISBN 1 85153 207 2. Reprinted from *Field Studies* 9 No. 4. (2000): 711–764. £5 plus 75p p. & p., payable to FSC, from Field Studies Council Publications, Preston Montford, Shrewsbury SY4 1HW.

This long-awaited publication fills an important gap in the literature. There have been numerous guides to identifying trees and shrubs in the summer, which are largely based on leaf shape, but, until now, few have tackled the far more challenging task of naming them in the winter. This book presents a dichotomous key, using the variable structure and arrangement of winter buds, for the identification of over seventy deciduous trees and shrubs. These have been selected as being 'common or familiar within Britain's major habitats, such as in woodlands, hedgerows, parks and towns'. All widespread native woodland trees and shrubs are therefore covered, plus a range of frequently encountered introductions. The many black and white illustrations nicely augment the text and point up contrasting features used in the key. As with all such Aidgap publications, this key has been extensively 'tested' by potential user groups prior to publication. I have tried it out myself on BTCV trainees attending a winter tree-identification course at Railway Fields and found that, on the whole, it worked well. Many students, however, found difficulty in deciding whether buds were arranged strictly alternately (species of lime *Tilia)* or spirally (willows *Salix,* and several other genera). Problems were also found in separating blackthorn *Prunus spinosa* ('large spine up to 5 cm long with buds situated along the spine') from the native hawthorns *Crataegus* spp. ('Small spine up to 3 cm long with buds above or adjacent to spine'). Students frequently overestimated the size of hawthorn spines by failing to distinguish them from the short lateral twigs which they often terminate. As these lateral twigs also carry buds, hawthorn can easily be misidentified as blackthorn. Apart from these minor difficulties, the majority of deciduous trees and shrubs found at Railway Fields (around thirty species) were correctly identified and most students found the key easy to use.

This guide will be particularly welcomed by those involved in woodland management, where much work is done during the winter. It should also be of great assistance to botanists carrying out winter surveys and to all those wishing to broaden their knowledge about our common trees and shrubs.

David Bevan

Fold-out charts review

Field Studies Council 'Occasional Publication' fold-out charts, available from Field Studies Council Publications, Preston Montford, Shrewsbury SY4 lHW, at price shown plus 75p p. & p. per chart, payable to FSC.

OP57 *Guide to commoner water plants.* Richard Orton and Anne and John Babbington. £3.25.

OP58 *A key to some common seaweeds.* Text by Steve Morrell, illustrations by Carol Roberts. £2.50.

OP61 *The rocky shore name trail: a key to common animals and plants on rocky shores.* Clare Cremona, Andy Simms and Mark Ward. 2000. £2.50.

These are three useful additions to the excellent series of laminated fold-out charts reviewed in 1999 *(Lond. Nat.* 78: 117). As before, one side of each chart contains illustrations and the reverse gives a short account of the organisms depicted, together with some useful information on their ecology and conservation. They are designed to appeal to users with little previous knowledge of the areas covered. This has necessitated a considerable simplification of some of the more complex groups. Thus, for example, in the *Guide to commoner water plants,* only four pondweeds *Potamogeton* spp. are illustrated and the water-crowfoots *Ranunculus* spp. are all lumped together. This seems a sensible approach to take in a guide for beginners, and references are given to more specialized works in both these instances. Problems could, however, arise over the identification of certain plants. For example, Canadian waterweed *Elodea canadensis* is the only species of *Elodea* described. In many parts of London, and I suspect elsewhere, this plant has now been replaced by its close relative, Nuttall's waterweed *E. nuttallii,* which looks superficially very similar and is therefore likely to be misidentified.

The rocky shore name trail takes a particularly broad-brush approach which should prove popular with families visiting the seaside, and the illustrated key is well designed for use by children. The *Key to some common seaweeds,* by contrast, has a more detailed dichotomous key to around thirty species and makes a more advanced introduction to a diverse group (there are more than 800 species of seaweed in Britain).

David Bevan

A history of the vertebrate fauna of Blackheath and Greenwich Park, 1850–1999

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Dedicated to the memories of Peter James Grant and Denis Frank Owen

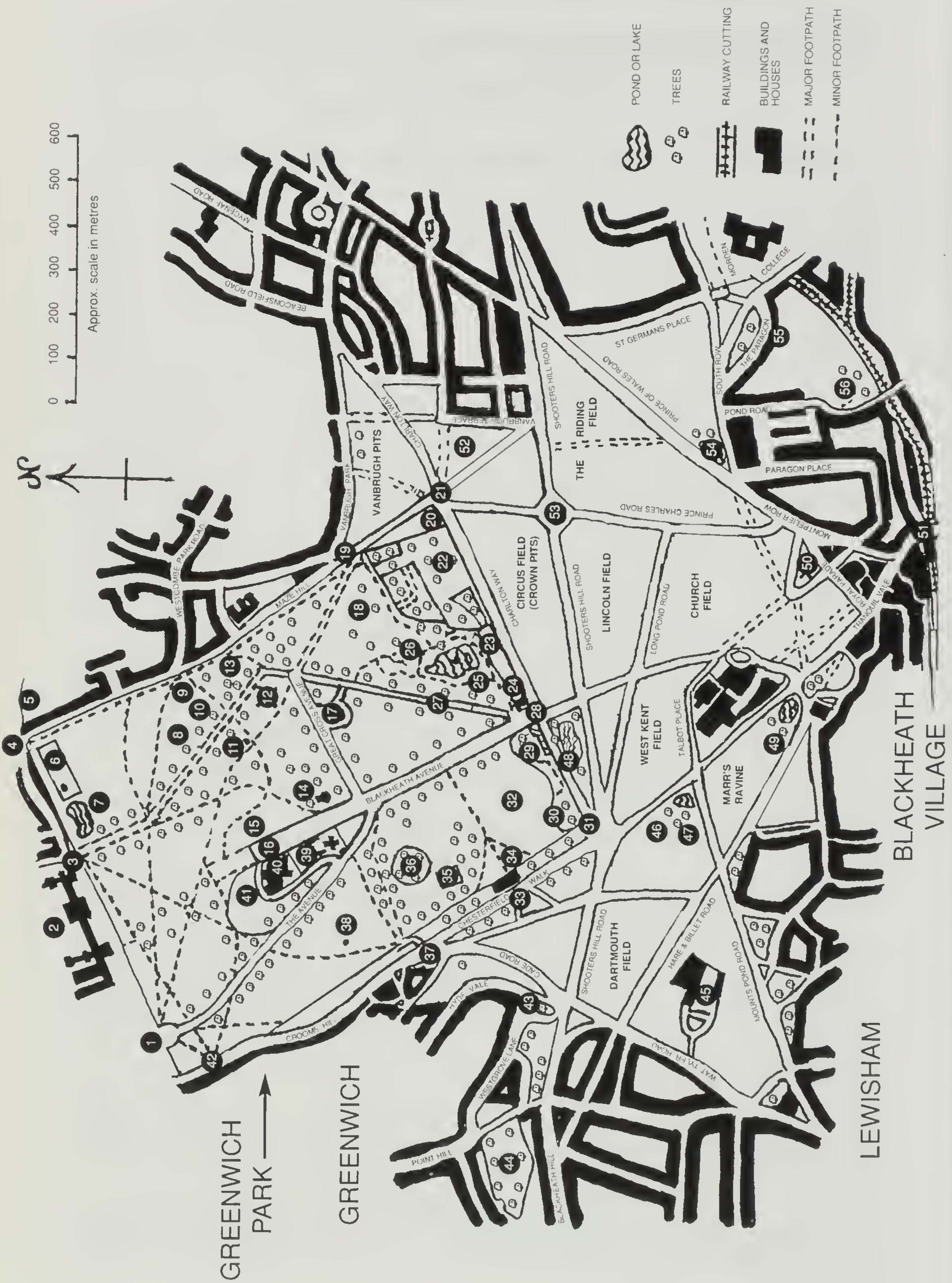
Summary 43
Introduction 45
The area, its history and habitats 45
Species accounts 53
  Mammals 53
  Reptiles and amphibians 57
  Fish 58
  Birds 58
Table 1 — Winter censuses by W. G. Teagle of selected bird species in Greenwich Park in 1958 and 1959 61
Discussion 93
Acknowledgements 95
References 96
Postscript 98

Summary

A detailed account is presented of the vertebrate fauna of Blackheath and Greenwich Park, a contiguous expanse of open space within the heavily built-up Kentish suburbs of London on the south side of the River Thames, much used and managed by man for several centuries. Despite being gradually engulfed over the past 150 years or so by urban development and isolated from once almost rural surroundings, small remnants of semi-natural habitats remain and the maturation of trees and shrubs in the gardens of post-war housing has apparently facilitated once more the movement of birds and other wildlife between them. At the beginning of the period discussed in particular detail in this paper, 1943 to 1959, tongues of unbuilt upon land and sports fields still virtually connected the south-eastern edges of Blackheath, through southern Charlton and Kidbrooke, to Shooters Hill and the Kentish countryside beyond.

Of 29 species of mammals, reptiles and amphibians listed as having been recorded from about 1850 onwards, two species — grey squirrel and fallow deer (scientific names of vertebrates are given in the systematic list) — have been introduced by man, of which only the grey squirrel is completely at liberty. Of 26 species stated to have occurred between about 1850 and 1901, at least 14 were definitely or thought to be still present in the 1940s and 1950s. Of these 14, one — rabbit — became extinct by 1944, and another — common lizard — was reintroduced in 1946, apparently only temporarily. In addition, two species of bat — Daubenton's and noctule — not recorded prior to 1901, though presumably present, were subsequently reported in the area, and the alien grey squirrel was introduced, thus bringing the 1940s–1950s species total to 17. Of 141 species of birds recorded over the period 1850–1999 (71 of which are known or believed to have bred, or attempted to do so, at least once), 131 have been recorded since 1901 (64 of which bred at least once). Since the complete encirclement of Blackheath and Greenwich Park by urban development from 1948, 16 species of mammals, reptiles and amphibians, and 123 species of birds, have been recorded, of which 53 of the birds have bred at least once, including *established* aliens.

Following a descriptive and historical introduction, the main part of the paper consists of a systematic survey of the species recorded in the area and concludes with a discussion, which includes some remarks concerning the future management of potential wildlife habitats there.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GREENWICH
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BLACKHEATH VILLAGE
VANBRUGH PITS
CIRCUS FIELD (CROWN PITS)
LINCOLN FIELD
CHURCH FIELD
THE RIDING FIELD
WEST KENT FIELD
MARR'S RAVINE
DARTMOUTH FIELD
MYCENAE ROAD
BEACONSFIELD ROAD
WESTCOMBE PARK ROAD
MAZE HILL
VANBRUGH PARK
CHARLTON WAY
VANBRUGH TERRACE
SHOOTERS HILL ROAD
ST GERMANS PLACE
PRINCE OF WALES ROAD
MORDEN
COLLEGE
SOUTH ROW
THE PARAGON
POND ROAD
PARAGON PLACE
PRINCE CHARLES ROAD
MONTPELIER ROW
ROYAL PARADE
TRANQUIL VALE
LONG POND ROAD
TALBOT PLACE
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Introduction

W.G. Teagle's (1997) excellent paper on birds and other wildlife of the south-eastern London suburb of Blackheath in the 1950s and 1960s has stimulated me to contribute my own observations to *The London Naturalist*, covering in particular the period 1943 to 1959 when, for the most part, I lived in the area. In addition I have drawn on published and, mainly from Teagle, unpublished records I have obtained covering various periods between about 1850 and 2000. The paucity of records for the twenty years after 1975 is particularly regrettable.

My family moved to Charlton in the Borough of Greenwich in 1943, when I was twelve years old and a birdwatcher of some three years' standing. We continued to live there until September 1959, so overlapping Teagle's period of residence by six years. Soon after he came to live in The Paragon at Blackheath in March 1953, I went to Oxford until September 1958, but during visits to my parents I frequently visited Blackheath and Greenwich Park. On a few occasions in 1953 Teagle and I undertook joint walks there, though my usual companions were K. H. Hyatt and the late D. F. Owen, and I am glad to be able to include their records in this paper. After 1959 our observations were confined to occasional visits, but since then the published studies of P. J. Grant (1967) and Teagle (1997), plus much unpublished data resulting from intensive work undertaken in Greenwich Park in 1958–9 by the latter author, have added to our knowledge.

The area, its history and habitats

Grant (1967), Rhind (1987), Swales et al. (1989) and Teagle (1997) have given comprehensive descriptions of Greenwich Park and Blackheath (Figure 1). Nevertheless, there are some items of interest which I can add, especially concerning the appearance of both areas during the Second World War and the early post-war years.

The 185 acres of Greenwich Park were first enclosed with a fence, in 1433, by Humphrey, Duke of Gloucester. In 1619 the fence was replaced by a wall (Webster 1902, Church 1956). Prior to enclosure, the Park, together with Blackheath, formed part of a forest which was an arm of the great Forest of Anderida. At the time of its enclosure, the Park was said to present 'a very wild and common-like appearance, being covered in part with scrub oak, thorns, birch, gorse, broom, and heath' (Webster 1902). The only survivors of this ancient forest are some of the old oaks *Quercus* spp. in the Wilderness (a small enclosed area in the south-east corner) and the much-decayed Queen Elizabeth's Oak (Figure 2), which, having died about 1878 (Webster 1902), was rendered unstable by the gales of 1990 and fell over during the night of

FIGURE 1. Blackheath and Greenwich Park.

Greenwich Park: 1 St Mary's Gate, 2 The Queen's House & National Maritime Museum, 3 Park Row Gate, 4 Creed Place Gate, 5 Maze Hill railway station, 6 Children's playground, 7 Boating lake (pond), 8 One Tree Hill, 9 Maze Hill Gate, 10 Lovers' Walk, 11 Site of Queen Elizabeth's Oak, 12 Site of the former Magnetic Observatory, 13 Roman remains site, 14 Restaurant, 15 The spring, 16 General Wolfe statue, 17 Bandstand, 18 Flower (Ornamental) Gardens, 19 Vanbrugh Park Gate, 20 The gardeners' nursery, 21 War memorial, 22 The Wilderness (deer enclosure) with the Small (top right), Large (top left) and Middle (bottom left) Bird Sanctuaries, 23 The Paddock, 24 The Lodge and its garden, 25 The ornamental lake (pond), 26 The Dell, 27 Bower Avenue, 28 Blackheath Gate, 29 The Rock garden, 30 The Rhododendron Dell, 31 Chesterfield Gate, 32 The Ranger's Field, 33 The Ranger's House, 34 The Rose Garden, 35 Tennis courts, 36 The covered reservoir, 37 Croom's Hill Gate, 38 The Henry Moore statue, 39 The Observatory garden and site of Greenwich Castle, 40 Old Royal Observatory, 41 Observatory enclosure, 42 Circus Gate.

Blackheath: 43 Site of the Chocolate Pond, 44 The Point, 45 Hollyhedge House, 46 Whitefield's Mount, 47 Whitefield's Pond, 48 Folly Pond, 49 Hare and Billet Pond, 50 All Saints' Church, 51 Blackheath railway station, 52 Former sand martin and barrage balloon site, 53 Camomile Bottom, 54 Prince of Wales Pond, 55 The Paragon, 56 Site of the former Round Pond.

1/2 July 1991 as a result of torrential rain. Henry VIII was said to have danced with Anne Boleyn under the shade of this ancient tree, believed to have been about 700 years old (*The Times*, 4 July 1991).

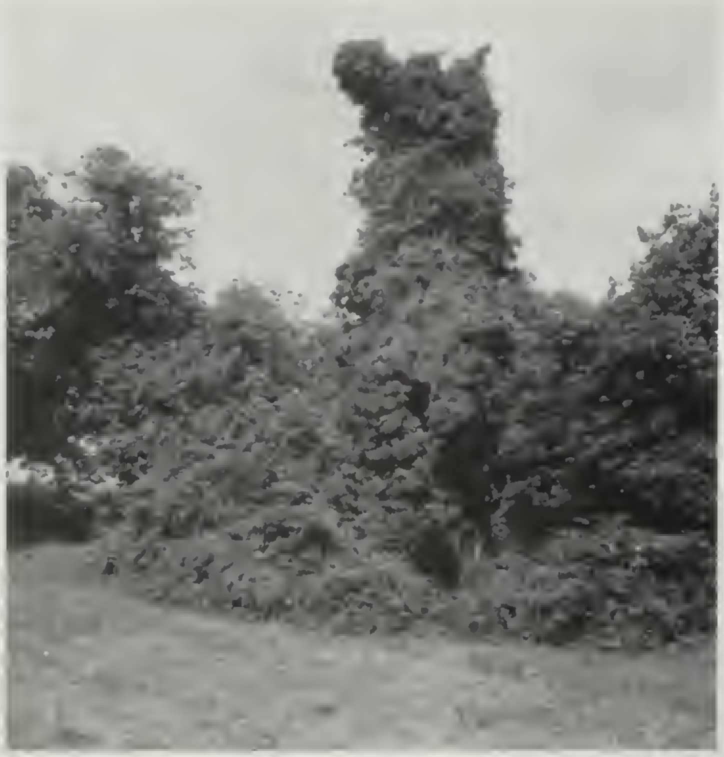

FIGURE 2. The ivy-covered trunk of the 700-year-old Queen Elizabeth's Oak in Greenwich Park, August 1958.
Photo: W. G. Teagle

The numerous avenues of sweet (Spanish) chestnut *Castanea sativa* (Figure 3) and elms *Ulmus* spp. were planted in 1665 and further tree planting proceeded systematically throughout the seventeenth and eighteenth centuries (Church 1956). These fine avenues are still a feature of the Park although, unfortunately, many of the trees have had huge branches lopped off and present a mutilated appearance. Two rows of Scots pine *Pinus sylvestris* from Scotland were planted on either side of the main terrace in 1669, but the last of these were felled about 1849 (Webster 1902). According to Webster, and also Church, sixteen small coppices of birch *Betula* spp., hawthorn *Crataegus* spp., ash *Fraxinus excelsior* and privet *Ligustrum* sp. were also planted around 1665 and some of these or their descendants still survive. The coppices (the later bird sanctuaries) in the Wilderness date from 1661–2 (Webster 1902).

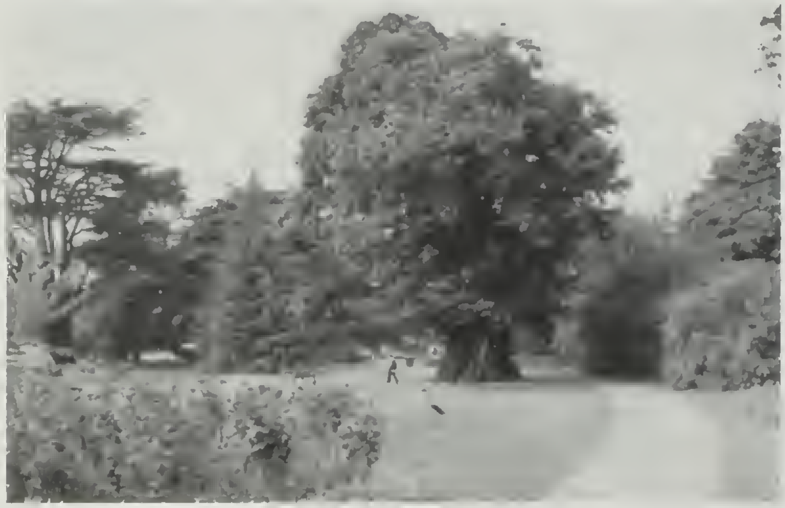

FIGURE 3. The Flower Gardens, Greenwich Park, 30 August 1983, with sweet chestnut planted in the 1660s.
Photo: J. F. Burton

Apart from the broad avenues of sweet chestnut and limes *Tilia* spp. and the scattered oaks, ashes, conifers, hawthorns and birches, there are open grassy slopes and plateaux, flower gardens with well-mown lawns, shrubberies and two lakes or ponds. These last are situated at opposite ends of the Park, the southern one being much the more natural looking, surrounded as it is by grassy banks, shrubberies, weeping willows (*Salix* hybrids) and other trees. The northern pond is concreted and little more than a boating pool.

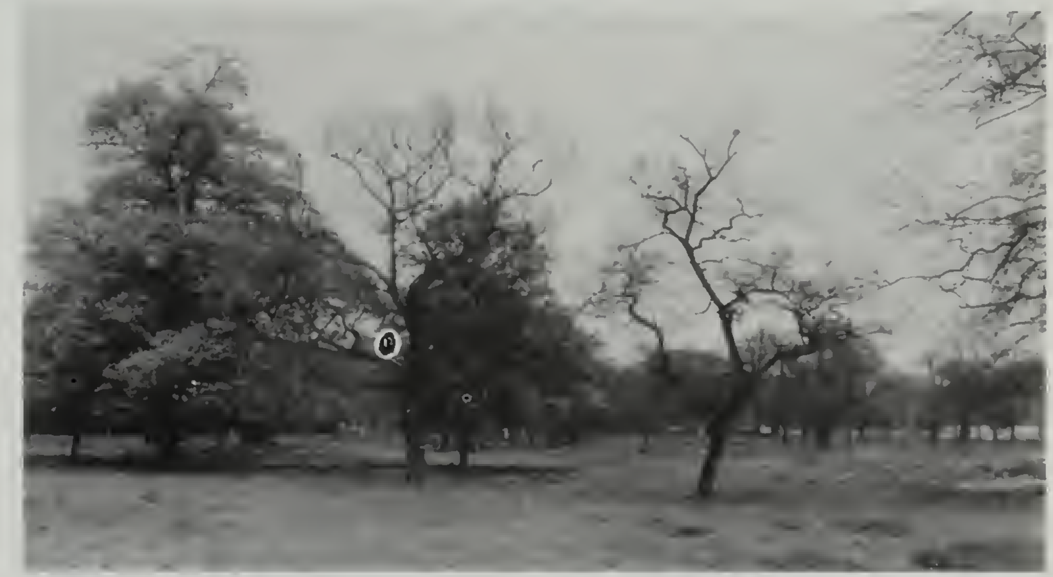

FIGURE 4. The Wilderness, Greenwich Park, April 1952. *Photo: J. F. Burton*

The most interesting part of the whole Park for the naturalist used to be the so-called 'Wilderness' (Figure 4), in the south-east corner containing the deer enclosure and bird sanctuaries which, as already mentioned, also contains relics of pre-enclosure (early fifteenth century) days. Up to at least the 1960s its thirteen acres still looked fairly wild and natural with scattered oaks, sweet chestnuts, elms and a ground flora of bracken *Pteridium aquilinum*, daffodils *Narcissus pseudonarcissus* (recorded here since at least 1836 (Grinling et al. 1909)), bluebells *Hyacinthoides non-scripta* and other plants. The narrow belt of thick woodland on its northern margin was fenced off quite early in the twentieth century, both to form three bird sanctuaries and to protect it from the small herd of fallow deer kept in the deer enclosure. What now remains of these sanctuaries, which contained more undergrowth in the 1940s and 1950s than indicated by Grant (1967), or exists at the present time, has been cut through by a public walkway — the Woodland Walk. On the north side of the Wilderness lie the Flower Gardens (Figure 3) with well laid out lawns and flower beds.

Up to the 1880s (Figures 5a, b) the country around Blackheath and Greenwich Park was essentially rural in character and largely unspoilt. Those readers who wish to gain some idea of the appearance of the Greenwich district in 1878 should read J.W. Tutt's foreword to West (1906) on 'The Lepidoptera of the southeastern district of London'. In the 1930s and even as late as the 1940s (Figure 5c), Greenwich Park was still linked to a certain extent by a relatively unbuilt on strip of countryside, the last 'wildlife corridor', extending through Blackheath, Kidbrooke and southern Charlton to the woodlands, golf course and farmland of Shooters Hill, thence to the Kentish countryside beyond. For instance, Mrs Audrey Batten has informed me that in the 1930s their house in Kidbrooke Park Road, on the south-eastern fringe of Blackheath, overlooked farmland, since completely built over. In 1948 that corridor was destroyed by the building of huge housing estates at southern Charlton and Kidbrooke, and the effect on the fauna of Greenwich Park soon became noticeable. Hitherto, the resident populations of at least some birds and insects in the Park had regularly been replenished from outside, but this virtually ceased after 1948 and some species, such as nuthatch and lesser spotted woodpecker, temporarily disappeared. Today (Figure 5d), Greenwich Park is almost entirely encircled and engulfed by extensive built-up areas, relieved on the south side only by the green levels of Blackheath, the former wild character of which has been almost completely erased since 1946 by so-called improvements.

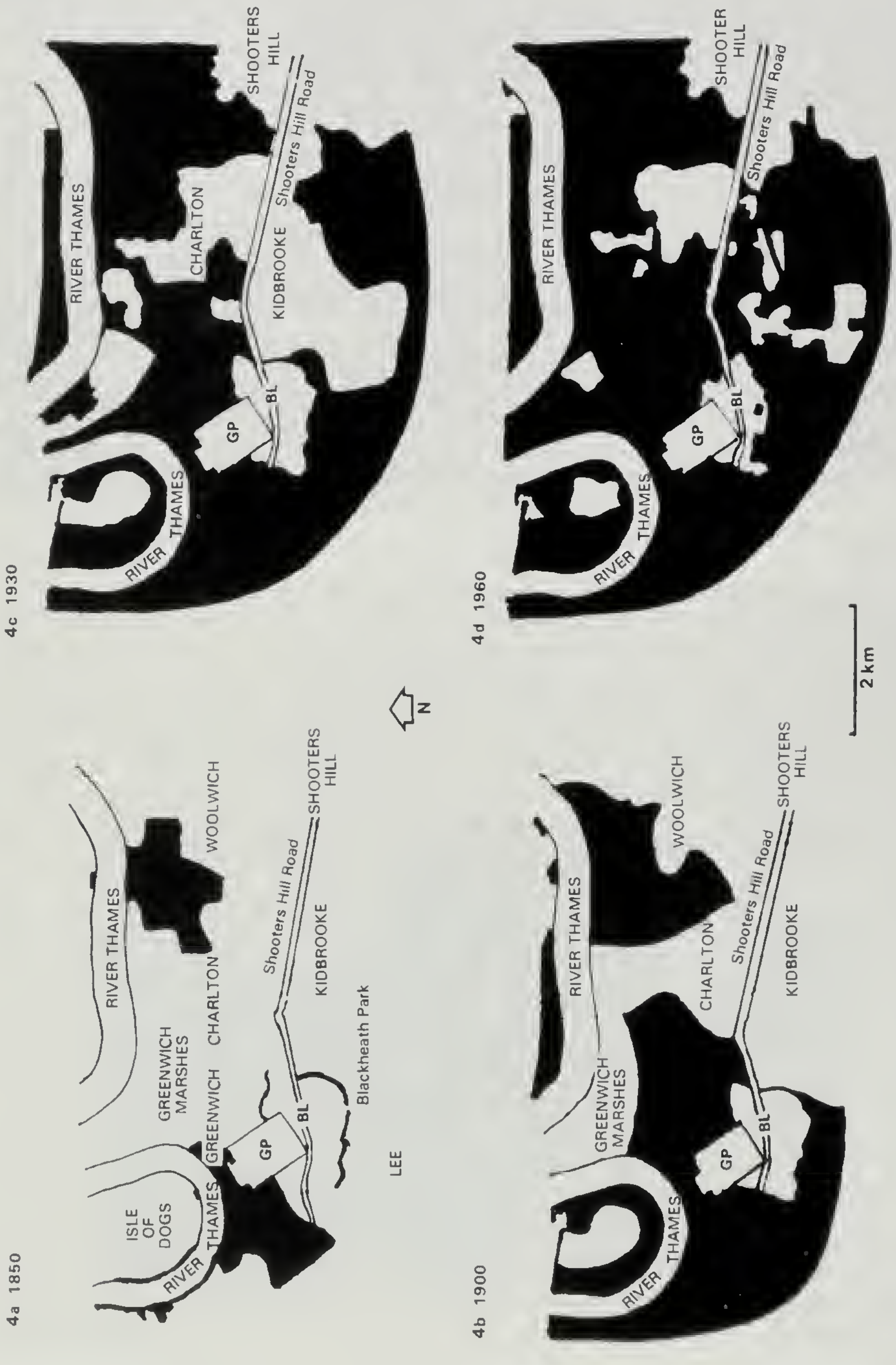

FIGURE 5. The area of south-east London surrounding Blackheath (BL) and Greenwich Park (GP) showing the growth of urban development from 1850 to 1960. Built-up areas shown in black.

The open plateau of Blackheath, from the northern part of which Greenwich Park was carved, was originally a typically wild common, some 38 metres above sea-level, similar to others in north-west Kent, such as Hayes Common. It was covered with heather *Calluna vulgaris*, gorse *Ulex europaeus*, broom *Sarothamnus* sp., wood sage *Teucrium scorodonia*, harebell *Campanula rotundifolia*, blackthorn *Prunus spinosa*, hawthorn, birch and scrub oak. According to the *Fauna of Blackheath and its vicinity*, published in 1859 by the Greenwich Natural History Club (hereafter referred to as GNHC), the Heath was the haunt of brown hares, stoats, weasels, common lizards, natterjack toads and such birds of heath and common land as yellowhammers, corn buntings, linnets, redpolls, meadow pipits, tree pipits, nightingales, various warblers and grey partridges. Even the Dartford warbler was reported to occur there in 1830. As late as the early part of the nineteenth century, highwaymen and footpads found Blackheath a safe hiding place for their nefarious activities (Rhind 1987).

Gradually, by the mid nineteenth century, much of this scrub was cleared away, except in the north-east corner, and was replaced by open grassland. Large trees had always been few, except on the periphery where they grew mainly in the large gardens of houses built from around 1690 onwards. The only area where gorse and wood sage still flourishes is in Vanbrugh Pits (Figure 6), the old gravel workings in the north-east corner, mentioned by Teagle (1997).

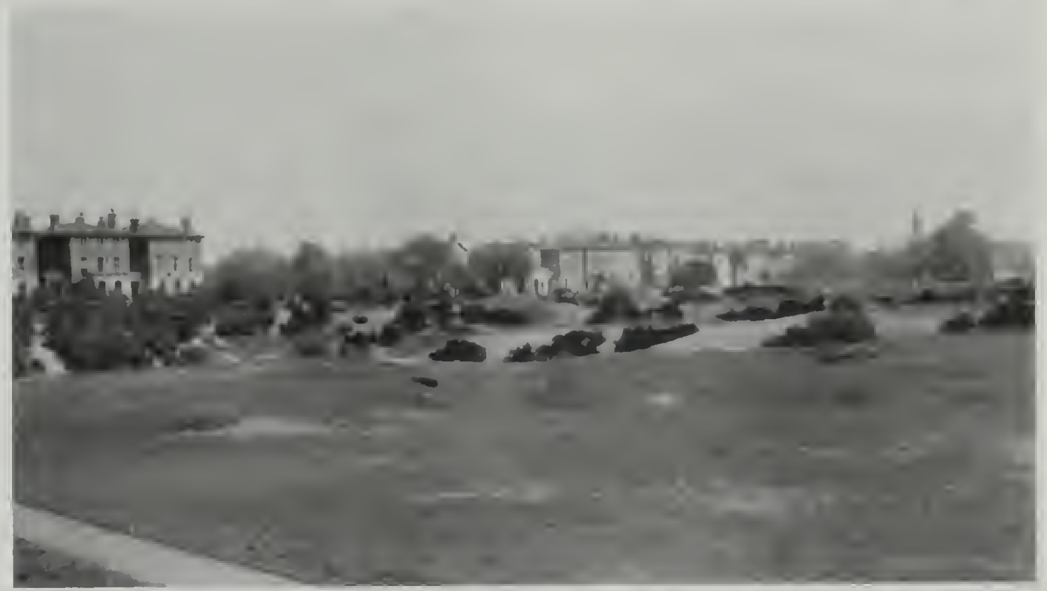

FIGURE 6. Gorse and wood sage still flourish in the Vanbrugh Pits at the north-east corner of Blackheath, seen here in 1952. *Photo: J. F. Burton*

When I first came to know Blackheath, in 1943, it was very much under the influence of the military. Anti-aircraft gun emplacements, searchlights, barrage balloons and mounds of earth to prevent aircraft landing were scattered on Circus Field, which replaced the infilled Crown Pits, while rows of army Nissen huts were a feature of Church Field to the south, near Blackheath Village. To the east, a large chunk of the Heath, opposite St German's Place, was occupied by a large number of prefabricated houses built for bombed-out families and intended to be temporary, although they were not demolished until the 1960s. A barrage balloon was housed in a deep gravel-pit between the southern ends of Maze Hill and Vanbrugh Terrace, which was later filled in, just as were the Crown Pits, the Old Donkey Pit and other old gravel-pits, with debris and rubble from the London bomb-sites. The almost sheer northern face of this barrage balloon pit was home to a few pairs of sand martins in 1943 and 1944 until, like the others, it was filled in with debris from bombed areas in, I think, 1945.

The wartime occupation of large parts of Blackheath by the military allowed the coarse grasses and other invasive vegetation to grow rank, making habitats conducive to breeding for such birds as yellow wagtail (Burton 1972), linnet and skylark, though the intermittent appearance of heavy army vehicles on the Heath did on occasion lead to unsuccessful breeding attempts by ground-nesting birds. Their breeding was also disturbed by the Easter and Whitsun fairs on the Heath's Circus Field when these resumed after the war. In 1949, this particular field still had in place rows of anti-aircraft-landing mounds and rubble overgrown with adventive weeds and grasses, providing attractive nesting habitat for skylarks and yellow wagtails. It remained more or less in this state until 1953. The military Nissen huts, taken over in late 1946 by squatters, were not finally vacated and demolished until about 1950, and from 1953 onwards the 'wild' areas mentioned above were 'reinstated', as described by Teagle (1997). Only Vanbrugh Pits were left in their original semi-natural state.

Some mention must be made of the Blackheath ponds: Real (Royal) Pond, Chocolate Pond, Folly Pond, Whitefield's Pond, Hare and Billet Pond, Prince of Wales Pond and Round Pond. Only four of these seven survive today: Real or Royal Pond, which used to exist at the bottom of the once-deep Crown Pits, now the flat Circus Field, was filled in in 1827, and Chocolate Pond, at the junction of West Grove and Hyde Vale, eventually went the same way in 1878 (Rhind 1987). In response to public demand for a replacement pond, Folly Pond (known to my friends and myself as the Boating Pond because paddle and rowing boats were available for hire until about 1946) was created in the early 1890s. On 30 August 1983, following a very dry summer, I noted that this pond had almost dried up and that some of the old crack willows *Salix fragilis* had been replaced by sapling willows and alders *Alnus glutinosa*. Subsequently, several of the remaining old trees were blown down in severe storms (Figure 7). Rhind (1987) mentioned that Folly Pond had been shrinking in recent years, but a standpipe has since been installed so that it can be refilled when necessary.

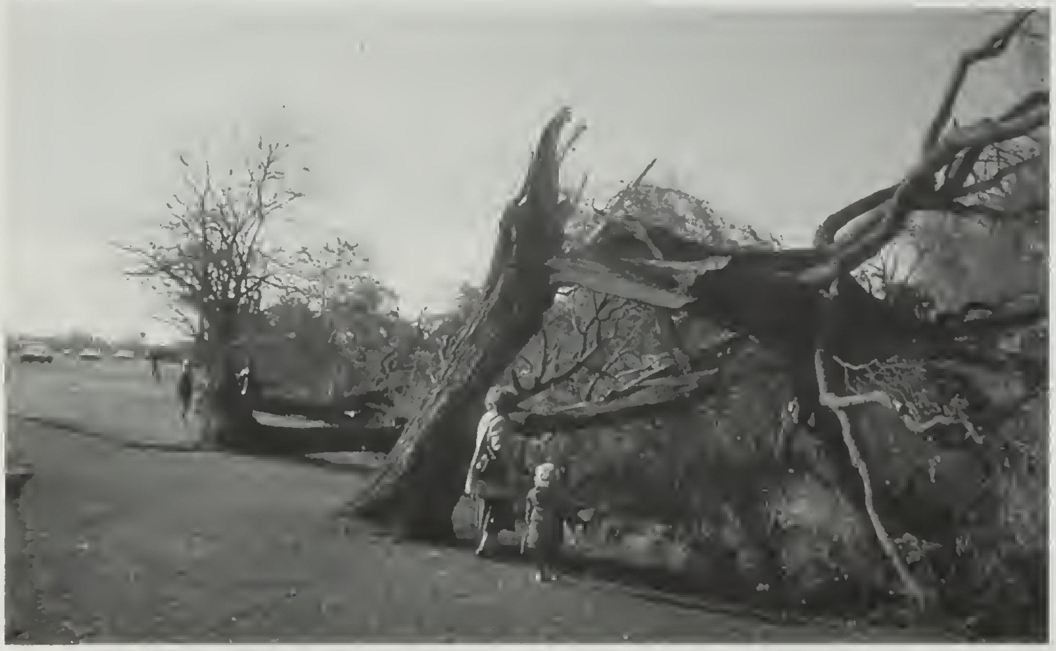

FIGURE 7. Storm damage by Folly Pond, Blackheath, 24 October 1987, following the severe winds which swept across south-east England during the night of 15/16 October 1987. *Photo: Ian Yarham*

On my 1983 visit I found that Hare and Billet Pond was still home to numerous three-spined sticklebacks and the trees that surrounded it included crack willows and two mature wych elms *Ulmus glabra*. The common elms *U. procera* and some old willows had been felled in 1975 but plenty of healthy suckers were growing from the stumps. The water level in Whitefield's Pond, adjacent to Whitefield's Mount (also known as Wesley's or St Michael's Mount), was then very low and contained much rubbish in addition to some sticklebacks. Prince of Wales Pond has changed little over the years and also contained some three-spined sticklebacks in 1983 and still does.

Unfortunately, I paid too few visits to Round Pond, off Pond Road, on the south-eastern edge of the Heath, of which Teagle (1997) gave such an evocative account of its appearance just before its final demise in the summer of 1953. It was already more like a swamp than a pond, being covered with yellow water lilies *Nuphar lutea* and edged with common reeds *Phragmites australis*, when I made my first visit on 3 May 1946 and found a nesting pair of moorhens. A pair was again present on 22 April 1947 together with three drake mallard. When I next went there, on 12 May 1949, moorhens and mallard were nowhere to be seen, but the surrounding willows held several goldfinches and greenfinches. The pond itself was almost completely dry, except in the middle.

Unlike Blackheath, Greenwich Park was relatively unaffected by the Second World War, except for the establishment of a considerable area of allotments in the northern part between St Mary's Gate and the boating lake, adjacent to the Queen's House. These were vacated by the end of the 1940s and restored to grassland.

During the war years the three enclosed bird sanctuaries in the Wilderness — Large, Middle and Small Sanctuaries — in the south-east corner of the Park had been much neglected and the growth of young trees and other secondary cover had become very dense, rendering them less attractive to warblers and some other passerines. As a result of the representations of myself and others to the Committee on Bird Sanctuaries in the Royal Parks, when I was an Official Observer for Greenwich Park in 1947–50, and again from 1951–3 and in 1958–9, the tree cover was eventually thinned-out in the course of the 1950s and early 1960s, as described by Grant (1967), and an attractive variety of shrubs planted. Grant was, however, incorrect in stating that hitherto the undergrowth was sparse or non-existent (Figure 8). Bracken and bramble *Rubus fruticosus* were among the

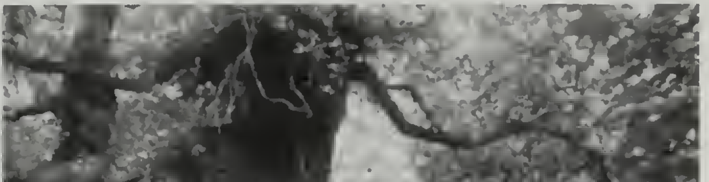

FIGURE 8. East end of Middle Sanctuary, Greenwich Park, May 1958, showing oak with ground cover of bracken and brambles. *Photo: W. G. Teagle*

species present and, for instance, I noted on 23 February 1952 that the Park Superintendent, T.C. Barbour, had cleared the too-overgrown parts of the Large Bird Sanctuary but had left ample cover in 'the right places'. He also had made by the Park staff, at my request, six tit nest-boxes and on 8 March 1952 I erected two of these on trees in the Middle Sanctuary, three on oaks in the Large Sanctuary and one in the 'new' rock garden, where a 'splendid, cascading stream had been installed'. On a much later visit to Greenwich Park, 28 July 1971, I was not quite so pleased with the condition of the bird sanctuaries as I had been in 1952. Various horticultural shrubs had been planted in them, such as roses and rhododendrons *Rhododendron ponticum*, which looked somewhat incongruous amongst the more natural vegetation. Since 1971 they appear to have been left untouched, apart from the recent construction of the Woodland Walk through the Large Sanctuary and the destruction of the Small Sanctuary.

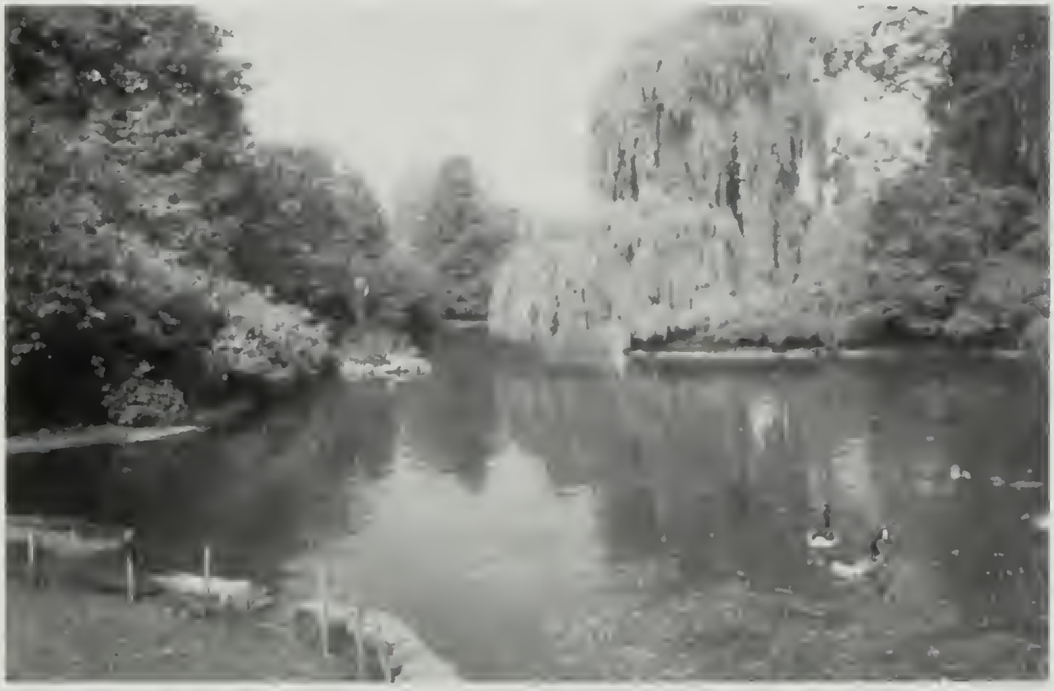

FIGURE 9. The ornamental lake in the Flower Gardens, Greenwich Park. Looking north, 9 May 2000. Canada geese and mallard in right foreground. *Photo: J. F. Burton*

The state of the ornamental lake (Figure 9) in the Flower or Ornamental Gardens (known as the Gardens Pond to P. J. Grant, W. G. Teagle, Eric Simms and others, but always called 'the lake' by my contemporaries and myself, and in this paper) concerned me a great deal in the early post-war years and I frequently complained about it to the Committee on Bird Sanctuaries in the Royal Parks. It had been in an unhealthy, leaking state for some years. In the winter of 1950–1, work began on cleaning it out and improving it but, when I looked there with the Superintendent on 14 January 1951, work had been halted about six weeks previously and it was in a filthy, muddy condition; all the waterfowl had left, even the moorhens. Fortunately, work resumed shortly afterwards and by mid February 1951 there was enough water to enable several mallard to return. By early December that year a couple of moorhens were back with the mallard, but the water was still 'very muddy indeed', improvement work having ceased again because, according to the Superintendent, of 'post-war shortages of material'. On 21 September 1952 I noted that the water level was 'extremely low and a good deal of mud had been exposed' with the result that no waterfowl were present. That winter, however, the lake was considerably improved and the mallard and moorhens returned to a healthier environment. Finally, by late February 1959 the problems were at length cured and, as mentioned by Grant (1967), such improvements as the provision of a small floating island planted with cover and the planting of a large quantity of aquatic and marginal plants around the lake's edges were subsequently made. When I visited the Park on 5 June 1974 I noted that it was well stocked with pinioned duck, such as shelduck *Tadorna tadorna*, in addition to wild mallard and moorhens, and that the island now had a waterfall which attracted passerines to drink. The following year, when I managed a brief visit on 4 September, I found the lake even more thronged with pinioned waterfowl of several species and was delighted to see around thirty sand martins on passage flying around it and skimming over the water surface.

On these occasional later visits between 1971 and 2000 I was, however, saddened to see some other changes which had been effected since I lived in the district. Already during the 1952–3 winter the old wooden barn in the enclosed and peaceful Paddock adjoining the Superintendent's garden, in which I was assured a pair of barn owls had nested at least once prior to 1943, had been completely demolished, and the old, derelict ivy-covered 'poultry' sheds had been reconstructed and the thick ivy *Hedera helix* removed. When I next saw the Paddock, on 28 July 1971, several recently constructed aviaries contained pheasants *Phasianus colchicus* and various ornamental game birds. A new rifle range and butts has been built from bricks to replace the old wood-and-earth structure. In the Superintendent's garden a tiny, ornamental pond had been constructed and a few species of aquatic plants installed.

In the Wilderness on that late July day in 1971 I was further saddened to see that the small disused gravel-pit and its large clump of thorn-apple *Datura stramonium*, reported by A.D. Webster in 1901 (Grinling et al. 1909), had both been eradicated. In their place stood a new, red-brick incinerator and a dump for the Park refuse. The following September, I found that the site of the former flower nursery in the extreme south-east corner of the Park had been greatly extended at the expense of the adjoining part of the Wilderness and, as I saw in May 2000, even more so at the expense of the Small Bird Sanctuary. Then, in August 1983, I noted that there was much less bracken in the Wilderness deer park than there used to be. Since then, as I saw in May 2000, it seems to have been eradicated altogether along with most of the other former attractive ground flora and replaced by large beds of stinging nettle *Urtica dioica*.

Species accounts

I originally intended to include both artificially introduced and escaped species, but have felt obliged to exclude them except in the cases of the fallow deer and the grey squirrel, which have long been established in Greenwich Park.

As references to the following works appear repeatedly, I have generally omitted giving the dates of publication: Barclay-Smith (1929–39), Grant (1967), Greenwich Natural History Club (GNHC) (1859), Grinling et al. (1909), Rendall (1937), Rhind (1987), Webster (1902) and Witherby (1895). The *London Bird Report* is referred to as *LBR* and *Bird Life in the Royal Parks* as *BLRP*.

MAMMALS

The nomenclature I have used is that of Corbet and Harris (1991). Although I kept an eye open for mammals, I did not look for them as keenly as I did for birds; this is especially true in the case of the mice and shrews.

Hedgehog *Erinaceus europaeus*: described in the late 1850s as common in the Blackheath area by the GNHC as was still the case in the 1940s and 1950s. I saw them most often in Greenwich Park during 1946–9, usually dead. One I found on 30 April 1946, curled up inside a large kettle abandoned in the Middle Bird Sanctuary, was an exception.

Hedgehogs were also reported in the Park by other observers from 1957–62 (Fitter 1960, Teagle 1963, 1965). Towns (1972) suggested that this population is a relict one, but I do not think this is so as hedgehogs could easily pass in and out of the Park gates at night and are capable of climbing quite high walls, as I once witnessed in the neighbourhood. Although I did not keep detailed notes of hedgehogs at Blackheath, Hyatt, Owen, Teagle and I saw them there in the 1950s (Teagle 1997). Patricia Brown tells me that she has not seen one at Blackheath for many years, but that they were still numerous in 1961, whilst Beames (1968) reported their occurrence in 1966.

Common shrew *Sorex araneus*: recorded in the early nineteenth century from the Blackheath district, including Greenwich Park, by the GNHC. I know of no later records in the area, though I found some dead in nearby Charlton and Kidbrooke in the late 1940s.

Water shrew *Neomys fodiens*: described by the GNHC as common in the Blackheath district in the early nineteenth century. I know of no other reports.

[**Daubenton's bat** *Myotis daubentoni*: at dusk on 27 April 1947, Owen saw three small bats flying over Prince of Wales Pond on Blackheath which were probably this species, as may also have been the small bats seen by Hyatt flying over the same pond on 1 May 1950 (Teagle 1997); however, it is also possible that they were pipistrelles. In the 1940s I saw considerable numbers of bats, which, judging by their flight behaviour, I considered to be Daubenton's, skimming very low back and forth over the surface of The Tarn at Mottingham, a few miles away.]

[**Serotine** *Eptesicus serotinus*: present in the Blackheath district according to the GNHC and observed in Greenwich Park (Fitter 1949*b*). At dusk on 12 June 1949 I watched three large bats flying in a rather slow, ponderous manner low over the ornamental lake in the Park which, because of this behaviour, I considered to be this species.]

[**Noctule** *Nyctalus noctula*: I am aware of the following probable records: 26 April 1947: at least eight large bats seen by Owen before dusk fell circling high over Blackheath, one the following evening and two on 2 May 1947. He wrote in his journal that they 'were very active, often diving down very quickly to catch insects. At least five arrived from Greenwich Park.' He heard them emit very high-pitched squeaks at times and considered them to be serotines, but I feel quite sure that they were noctules, judging by their flight behaviour and the fact that they emerged before dusk. Corbet and Southern (1977) state that noctules often emerge very early before sunset. On 12 June 1949 I watched a large bat flying high over the Flower Gardens in Greenwich Park which I considered to be a noctule; 13 May 1950: a few seen by Owen and myself flying high over Blackheath before dusk were also thought to be this species; 7 August 1959: a medium to large-sized bat seen by Teagle (1997) hunting around trees behind The Paragon at Blackheath may also have been a noctule from his description of its flight behaviour.]

Pipistrelle *Pipistrellus pipistrellus*: described by the GNHC as very common in Blackheath and district and this was later confirmed by B.W. Adkin (in Grinling). Pipistrelles continued to be seen during the twentieth century in small numbers and still are, though precise identifications are few. Bats thought to be of this species were seen in flight by Owen and myself at Blackheath in 1947, including one flying around St George's Church on 1 April, and in Greenwich Park in 1949, where at dusk on 14 July Owen and I watched a few probable pipistrelles leave a hole in a tree by the lake in the Flower Gardens. On two occasions in August 1958 Teagle (unpub. notes) saw a very small bat, which may have been a pipistrelle, flying in the southern third of the Park.

Rabbit *Oryctolagus cuniculus*: reported by the GNHC to be very common in the Blackheath district; it was still, according to Webster, abundant in Greenwich Park from 1896–1901. Rabbits gradually died out in the Park during the first half of the twentieth century and I found the remains of the last known survivor in the Wilderness in 1944, as mentioned in Fitter (1949*b*).

Brown hare *Lepus europaeus*: described by the GNHC as formerly common in the Blackheath district. By the early 1940s it had certainly disappeared there, although some survived on the Thames Marshes as near as Plumstead.

Grey squirrel *Sciurus carolinensis*: the native red squirrel *S. vulgaris* appears to have long vanished from the Blackheath district as it was not mentioned by the GNHC and the nearest localities at the beginning of the twentieth century where it could still be seen were several miles away in the Bromley area (Grinling). Its place has, of course, been taken by the alien grey squirrel which was introduced into the London area in the early years of the twentieth century: the first two were seen at Greenwich and Deptford before 1911 (Fitter 1939). It colonized the Blackheath area, including Greenwich Park, soon after the First World War but, owing to official persecution, was driven to extinction by 1943 (Teagle 1963). Fitter (1939) mentioned that only two were shot in the Park between 1932 and 1939. However, it reappeared in 1946 and throughout 1948 there were at least four present. From 1949 up to 1958 four was the maximum number known to be present (Burton 1962, Teagle 1963). In 1959 up to seven were seen regularly, rising to ten in 1960. After that numbers escalated and they became increasingly bold, which they had not been previously. Teagle (1964) reported: 'in 1961 squirrels were seen coming to visitors for peanuts and other delicacies'. As many as nineteen were recorded in the Park in October 1962 (Teagle 1965) and during a visit on 5 June 1974 I was amazed how numerous and tame they had become. On my next visit, 4 September 1975, I noted that they were 'everywhere, especially in the Flower Gardens and around the lake where I saw between 20 and 30'. They were just as numerous and tame, running up to people for food, when Owen and I arrived on 30 August 1983 to make a BBC radio programme, and on my subsequent visits on 30 June 1989 and in May 2000.

I do not recall seeing grey squirrels around Blackheath in the 1940s and 1950s; neither did Teagle (1997) during 1953–61. However, Hyatt informed Teagle that he had done so and his mother saw one in St German's Place on 28 August 1962 (Teagle 1997). Subsequently, the grey squirrel was recorded at Blackheath in 1966 (Beames 1968).

Grey squirrels in Greenwich Park were known to be responsible for losses of eggs and young birds. As well as eating bread and other scraps provided by human visitors, I saw them eat acorns and sweet chestnuts and pieces of fungus. Teagle (pers. comm.) watched one eat a piece of brown-gilled fungus and the fruits of sycamore *Acer pseudoplatanus*. They were also seen by both of us to bury and, later, dig up and consume acorns.

Field vole *Microtus agrestis*: described by the GNHC as common in the Blackheath district in the mid nineteenth century and still fairly common there and in Greenwich Park in the 1940s and early 1950s, judging by remains found in kestrel and tawny owl pellets. Not mentioned by Teagle (1997).

Water vole *Arvicola terrestris*: also described by the GNHC as common in the Blackheath district, but I feel sure that it was largely confined to Greenwich Marshes which the Club included within its area. However, it is possible that it may have inhabited the old ponds on Blackheath, the now vanished Round Pond, off Pond Road, being the most likely. I know of no twentieth century records in the area.

Wood mouse *Apodemus sylvaticus*: in the mid nineteenth century said by the GNHC to be 'very common'. It was still plentiful at Blackheath and in Greenwich Park in the 1940s and early 1950s, judging by the remains of them we found in kestrel and tawny owl pellets. I am unaware of more recent records, but it probably still occurs in small numbers.

Harvest mouse *Micromys minutus*: described by the GNHC in the mid nineteenth century as 'not uncommon' in the Blackheath district, but not recorded since then.

House mouse *Mus domesticus*: on 17 January 1960 Teagle (pers. comm.) watched a house mouse come out of the shrubbery by the lake in Greenwich Park to take bread thrown to the waterfowl by members of the public. I do not know of any other actual records from the area though presumably it is still present.

Brown or **common rat** *Rattus norvegicus*: described by the GNHC as 'abundant' in the Blackheath district and apparently remains so in spite of modern control measures.

Black or **ship rat** *R. rattus*: the GNHC stated that it occurred in a few places in the Blackheath district but I know of no more recent records other than that it was present in the Borough of Greenwich in 1956 (Bentley 1959).

Common dormouse *Muscardinus avellanarius*: I am not aware of any records since it was described by the GNHC as common in the Blackheath area in the mid nineteenth century.

Fox *Vulpes vulpes*: in 1859 the GNHC stated that the fox was not uncommon formerly in the Blackheath district and Grinling gave no other records for this area, though it was mentioned that it was rare in the Bromley district not far away. Further information on the distribution and status of the fox in the north-west Kent/south-east London area was lacking until the early 1940s when I found that they were not uncommon in the area around my then home at the edge of Elmstead Wood, Mottingham. Later, when I moved to Charlton, I located foxes on nearby Shooters Hill in 1944. One evening towards dusk that year I was surprised to see a fox trotting along Shooters Hill Road towards Shooters Hill; it took little notice of the few people besides myself out walking at the time. Earlier that day, a fox had been seen in Greenwich Park, but it may not have been the same individual as I saw; however, I do believe that foxes penetrated to Blackheath and Greenwich Park from the extensive woods, farmland and golf course on Shooters Hill via the more or less unbuilt-on land then existing (until 1948) on the south side of Shooters Hill Road. Eventually, a dog fox was shot in Greenwich Park early in the morning of 19 January 1947 by the Park authorities after it had killed a tame goose.

Figures supplied to Teagle (1967) by the Ministry of Agriculture, Fisheries and Food showed that by the late 1940s foxes were, in fact, already present in the Kentish suburbs of London in remarkable numbers. Altogether 413 were shot between 1947 and 1949. Therefore, it seems probable that foxes had been appearing in the Blackheath area on a larger scale than local naturalists, including myself, actually realized.

In December 1961 a fox was reported to be living in Greenwich Park; in April 1962, an accredited naturalist, P.C. Tinning, obtained a close view of it, or another individual, in the Wilderness. It was considered to have been responsible for the deaths of a number of wild mallard during the breeding season. A fox was again seen in the Park in January 1963, and three were shot there between January and May 1965. In 1963 and 1964, foxes were confirmed as breeding at Blackheath when an occupied earth was discovered in a garden (Teagle 1967). In 1963 breeding was also proved in Greenwich Park when a litter of six cubs was found in an earth under a shed but, fortunately, there was no evidence that the Park's mallard suffered as they did in 1962 (Tinning et al. 1966). Over three months in 1970, fourteen foxes were shot in the Park and one night about this time a three-quarters grown fox cub tried to play with the Superintendent's Jack Russell terrier despite the presence of a human observer (Simms 1974).

Since these records it has ceased to be unusual to hear of foxes breeding in the Blackheath area (Rhind) or in Greenwich Park. In August 1983, for instance, Owen and I found an apparently occupied earth at the base of Whitefield's Mount on the Heath, overlooking the pond. Patricia Brown informs me that they 'have been a daily sight for years' in the area.

Stoat *Mustela erminea*: used to occur not uncommonly up to the mid nineteenth century, according to the Greenwich NHC, but I know of no later records.

Weasel *M. nivalis*: in the mid nineteenth century the weasel was described as common at Blackheath by the GNHC but I know of no records since then, although I did occasionally see this mammal a few miles away on the golf course at Shooters Hill in the 1940s.

[**Badger** *Meles meles*: the GNHC, Grinling, and Teagle (1997) made no mention of the occurrence of badgers in the Blackheath area and I know of no records myself. However, Swales et al. (1989) made the surprising assertion that badgers 'have also been known to take up residence' in the Wilderness and the adjacent bird sanctuaries of Greenwich Park.]

Fallow deer *Dama dama*: a herd of fallow deer was introduced into Greenwich Park long ago and, as old pictures show, from at least the eighteenth century until about the First World War was allowed to wander freely about the whole Park. Old photographic postcards from the early 1900s show the deer doing so and being hand-fed by human visitors. It was, I understand, the feeding by visitors of unsuitable items that eventually led to them being confined to an enclosure within the Wilderness. One postcard I have from this period shows about 40 grazing at the eastern edge of the Ranger's Field, close to Blackheath Avenue, but it is difficult to obtain an accurate count as individual animals are not clearly visible in the background of the faded photograph. By the time I first visited Greenwich Park, in 1943, the herd in the Wilderness (Figure 10), mostly 'melanics' or 'blacks', was very small. I did not begin counting its size until 23 February 1952, when there were nine, including one young buck. By 22 February 1953, the herd had grown to 14, five fawns having been born the previous spring; on 13 February 1958 there were 12, five of them bucks; on 10 January 1959 the number had grown to 14 (including five bucks) and this was still the case on 1 March 1959. After 1959 I seldom visited the Park and, when I again made a count, on 4 September 1975, there were 36, mostly of the typical (common) form, plus a few 'melanics' and one semi-albino or 'white' form, so the total number was again approaching that of the early 1900s. However, at the end of 1999, Patricia Brown (pers. comm.) reported that only 13 were present, but said that the number fluctuated.

Having been so long established, the fallow deer have become integrated into the ecology of the Park. For example, the minotaur beetle *Typhaeus typhoeus*, normally dependent upon rabbit dung, utilizes the deer dung for its larval food balls in the absence since the early 1940s of rabbits. Without the deer, this beetle would probably disappear from Greenwich Park.

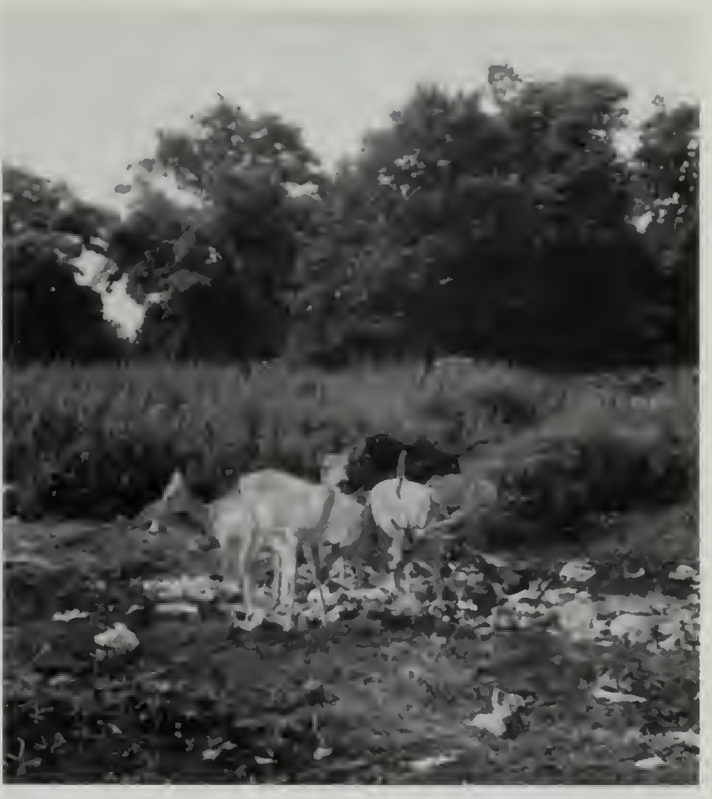

FIGURE 10. Fallow deer feeding at the refuse dump in the Wilderness, Greenwich Park, August 1958. *Photo: W. G. Teagle*

REPTILES and AMPHIBIANS

Nomenclature follows that used by Langton (1991).

Grass snake *Natrix natrix*: described somewhat ambiguously by the GNHC as 'not common' in the Blackheath district, this snake seems to have lingered on well into the twentieth century: a correspondent to *The Blackheath Local Guide and District Advertiser* of 4 December 1937 mentioned that he had a 27-inch specimen preserved in spirits which had been killed in his garden about twelve years previously (i.e. about 1925). I know of no other record.

Common lizard *Lacerta vivipara*: said in 1859 by the GNHC to have been common on Blackheath in the past, I have never heard of it being found there since. My friends and I certainly failed to discover it in the 1940s and 1950s in the one remaining area of suitable habitat in the north-east corner of the Heath or in the semi-natural south-east corner of Greenwich Park. However, in April 1946, Owen and I released five males and five females from Hayes Common, Kent into Greenwich Park's Wilderness. These clearly became temporarily established as, two years later, on 23 April 1948, I watched one basking on the rim of a small bomb crater in the Middle Bird Sanctuary of the Wilderness.

Slow-worm *Anguis fragilis*: in 1859 the GNHC stated that this lizard was 'not uncommon' in the Blackheath district at that time, but the only record of a wild individual since then of which I am aware is one seen by Owen at Lewisham, quite close to Blackheath, in October 1949 (Fitter 1950). However, Owen and I released a male and a female we caught on 13 April 1946 at Hayes Common, Kent, two days later in Greenwich Park.

Common toad *Bufo bufo*: described in 1859 as common throughout the Blackheath district by the GNHC, it still occurred there when I came to live in the area. Teagle

(1997) recorded them breeding in Prince of Wales Pond in the 1950s and noted their presence in Hyatt's garden. He also met with live individuals at The Paragon and road casualties near by. Langton's (1991) pre-1980 distribution map includes two black spots for the species on the southern edge of the Blackheath district, but gives no records in that for 1980–1990. However, Archer (1987) stated that it breeds in Hare and Billet Pond.

Natterjack toad *B. calamita*: said in 1859 to have been common formerly on Blackheath (GNHC), it has long since become extinct.

Common frog *Rana temporaria*: stated by the GNHC to have been abundant throughout the Blackheath district in the mid nineteenth century, it was still present in reasonably good numbers in the 1940s and the early 1950s, including Greenwich Park. Langton (1991) indicated sites for it within the area on his distribution maps covering the pre-1980 and 1980–90 periods, and Archer (1987) mentioned that it breeds in Hare and Billet Pond.

Common or **smooth newt** *Triturus vulgaris*: according to the GNHC, in 1859 this newt was abundant in the Blackheath district and, though it has perhaps become rather less common since, it is probably still to be found in at least some of the ponds and garden pools in the area. Rhind mentioned Whitefield's and Hare and Billet Ponds, and Teagle (1997) the former Round Pond in 1953 and, also in the 1950s, Hyatt's garden pond in Kidbrooke Gardens, just off the south-east corner of the Heath. Teagle also found several in 1957 in the garden of The Paragon, mostly under bricks. Owen and I used to find common newts in most of the Blackheath ponds in the 1940s, including Folly Pond and Prince of Wales Pond. Langton (1991) marks a single black spot within the Blackheath area on his pre-1980 distribution map, but none for that covering the period 1980–1990. It would appear that inadequate information was available to him as Archer (1987) as well as Rhind mentioned it as breeding in Hare and Billet Pond in the 1980s.

FISH

Three-spined stickleback *Gasterosteus aculeatus*: common in the ponds and ditches of the Blackheath district in the mid nineteenth century (GNHC), this fish has continued to flourish in the area ever since. Owen and I found it in all the Blackheath ponds in the 1940s and still plentiful in Hare and Billet, Prince of Wales and Whitefield's Ponds during our visit on 30–31 August 1983, as did Archer (1987), but not in Folly Pond, which had almost completely dried up in the drought of that summer. Teagle (1997), however, had found it in Folly Pond in the 1950s as well as Prince of Wales Pond; both these sites are also mentioned in Wheeler (1958).

BIRDS

Nomenclature follows the *London Bird Report* for 1998. Unlike Grant and Teagle, my contemporaries and I made little attempt at censuses or transect counts. I made some incomplete counts in 1953 and 1958–9, and counted or estimated the number of breeding pairs of the less-common species. Thus my birdwatching in those days was mainly recreational and unsystematic.

I was only twelve when I began birdwatching on Blackheath and in Greenwich Park and did not begin keeping a regular journal of my observations until October 1943; even then there were gaps, as in 1945, when my birdwatching in the first part of that year was inhibited by the horrific V-2 rocket attacks, from which I had a couple of narrow and lucky escapes. From 26 January 1946 the entries in my journal became steadily more regular and consistent. In April 1947 I obtained adequate central-focusing binoculars (6 × 30) which improved my birdwatching efficiency, and I did even better in 1952 with the purchase of 9 × 35 binoculars.

As my birdwatching was mainly recreational, I did not always cover the whole area on my visits, but concentrated on the parts I found most productive. These also happened to be the nearest to my Charlton home. The southern part of Greenwich Park, especially the Wilderness and its enclosed bird sanctuaries, the Flower Gardens and the lake area, and the parts of Blackheath adjacent to the

Park, such as the semi-natural Vanbrugh Pits, received most attention. It was only later that I regularly covered the northern parts of Greenwich Park, unlike Grant and Teagle who consistently watched these areas in their studies.

In May 1947, when the Committee on Bird Sanctuaries in the Royal Parks resumed its work after the wartime break, and I was sixteen, I was appointed an Official Observer for Greenwich Park, together with F. J. Holroyde. I was thus authorized to enter the Wilderness, the bird sanctuaries and the Paddock, which were closed to the public. Except when away from the district, I was an Official Observer for Greenwich Park until the end of 1959, after which I moved to Bristol to join the BBC Natural History Unit.

Little grebe *Tachybaptus ruficollis*: there are mid nineteenth century records from Blackheath (GNHC) and it is included in the 1896–1901 list of the breeding birds of Greenwich Park by Webster. One, possibly a juvenile, was seen on the Park lake on 26 August 1961 (Teagle et al. 1964) and another from 24 April–4 May 1964 (Tinning et al. 1966). It is also mentioned as having been observed in the Park in 1974 (*BLRP* 1974), but no details are given. In 1999, one was seen on the lake on 16 May (Brown 2000).

Cormorant *Phalacrocorax carbo*: until the River Thames was cleaned up in the 1960s and 1970s, few cormorants penetrated upriver to Greenwich. In 1895, Witherby reported that a party of seven had been seen flying over Blackheath. Three were seen over the Park during a half-hour migration watch on 27 October 1960 (Teagle and Tinning 1962), and two on 2 April 1966 (Grant). Though now always on the Thames, especially in winter, they are not often seen flying over Greenwich Park and rarely land. A juvenile visited the Park's ornamental lake early on 2 September 1996, eventually flying away (Brown 1998), and in 1998 one circled it on 15 September before flying towards the Thames (Brown 1999).

Grey heron *Ardea cinerea*: around the beginning of the twentieth century H.F. Witherby (1895) and J.W. Tutt (Grinling) occasionally saw grey herons flying over Blackheath. The first one I saw flew over Greenwich Park on the afternoon of 25 October 1946, mobbed by rooks. In 1956, one flew over The Paragon at Blackheath on 2 August (Teagle 1997) and in both 1965 and 1966 passage over Greenwich Park during August was noted, with five in the first year and one in 1966 (Grant). Nowadays, they commonly feed along the Thames and overflying is not unusual. In the Park one has frequented the lake since April 1996 and vigorously drives off other herons whenever they arrive (Brown 1998, 1999, 2000).

Mute swan *Cygnus olor*: in the mid nineteenth century (GNHC) and before the Second World War birds were occasionally seen on Blackheath ponds, and on Greenwich Park lake, where a pair bred in 1930 and 1931, before being removed as they constantly harried the other waterfowl (Barclay-Smith). Subsequently, this species rarely visited either the Park or Blackheath until Teagle occasionally saw one or two on the Heath ponds through the 1950s. In Greenwich Park, a pair failed to alight on the lake on 21 February 1954 and flew on to Blackheath. A cygnet made a brief stay on this lake on 14 October 1955. A pair was present in late January 1958 and a couple flew southwards in Greenwich Park and out over Blackheath on 24 October (Teagle). From 1965, mute swans were more often reported flying over the Park (a pair tried to breed in 1966, but were removed to the Thames by Park staff), or landing on the Blackheath ponds (Grant). More recently, one was briefly on the Greenwich Park lake on 17 April 1996 and on 20 March 1997 one flew west along the southern edge of the Park (Brown 1998).

[**Bean goose** *Anser fabalis*: there is an old mid nineteenth century statement (GNHC) that this species was seen on Blackheath and Rendall included it in his Blackheath list without any supporting details. These records presumably refer to birds seen flying overhead and one cannot help believing, in the light of present knowledge, that they were more likely to have been white-fronted geese *A. albifrons*.]

Goose sp.: on 30 January 1960, Teagle and Tinning (1962) saw a flock of *c.* 70 grey geese fly towards London over the north-east corner of Greenwich Park. As it was dusk, plumage details could not be seen, but their calls suggested white-fronted geese *A. albifrons*.

Greylag goose *A. anser*: the currently increasing semi-feral population in Britain implies that some will visit this area. Thus, in 1996, two visited the lake in Greenwich Park on

23 March and two were again there on 24 April. In 1998, two on the lake early on 13 February flew off southwards and in 1999 two appeared on 30 April (Brown 1998, 1999, 2000).

Canada goose *Branta canadensis*: in 1929, a pair, presented by the Duke of Bedford, was introduced to the lake in Greenwich Park (Barclay-Smith). With an increasing feral population in England, it became only a question of time before this species occurred naturally: the first was seen on the Park lake on 8 April 1966 (Grant 1967); a pair was present there in June 1968 (Grant 1970); birds flew over the Park in 1969, and Owen and I noted one on the lake on 30 August 1983. Now the Canada goose is an established part of the Park scene: a few pinioned birds still live on the lake. From the latter part of July to the end of winter (when most disperse) the lake is daytime home to 50–70 free-flying birds. They leave at dusk for roosts believed to include Dockland waters north of the Thames and various waters between Blackheath and Bromley. In 1996 one pair raised five goslings, but breeding is discouraged, although in 1998 a pair was allowed to raise five young, only two of which survived (Brown 1998, 1999, 2000).

Wigeon *Anas penelope*: pinioned pairs were occasionally placed on the lake in Greenwich Park in the 1930s and later. In 1966 some pinioned birds were joined from February to May by a free-winged female which was noticeably wilder in its behaviour. The previous year, a party of eighteen arrived on the lake in the evening of 20 March and had disappeared by the next morning (Grant). The only other record I have discovered of wild wigeon visiting the area is a mid nineteenth century record from the Blackheath ponds (GNHC).

Teal *A. crecca*: reported from the Blackheath ponds in the mid nineteenth century (GNHC). Pairs were recorded as occasional visitors to Greenwich Park from 1896–1901. I saw a party of five on the ornamental lake in the Park with a duck goldeneye in December 1944. On 13 July 1965, a party of nine landed on the lake in the evening; by next morning they had gone (Grant).

Mallard *A. platyrhynchos*: Hudson (1898) did not mention this species in Greenwich Park and Webster implied that a century ago it was only a timid visitor, yet to show any tendency to tolerate people at close quarters. But by the late 1920s and the 1930s, several pairs bred annually in the Park, near the ornamental lake, and in the bird sanctuaries and the Wilderness (Barclay-Smith). By 1935 a considerable increase in breeding pairs was reported, but first broods were often destroyed by crows or rats and, from 1934–7, by the resident Egyptian goose *Alopochen aegyptiacus*. In 1937, a nest was found four metres (13 feet) up in a sweet chestnut tree in the Wilderness, a practice that became increasingly popular with the Park's mallard.

By 1938, many mallard broods hatched in Greenwich Park (Barclay-Smith), and I found much the same happening in 1943. I began recording the numbers of birds on the lake in the autumn of 1946, when I counted 83–90 on several dates in October, but only 43 on 23 November. I made even fewer counts in 1947, recording up to 50 in October and 61 in November. That year I also looked for nests, finding, with my fellow official observer, F. J. Holroyde, a female sitting on seven eggs in a ground nest in the Large Sanctuary.

From 1948–59, at least five pairs nested annually, except in 1950 when the resident population was reduced by the pitiable state of the lake and only a single pair was known to have bred successfully. Although it was not until late February 1959 that intermittent work to cure leaks was finally completed, the mallard population steadily recovered from 1953 and increased so that, for example, about 60 could be seen on the lake in March and about 40 in October that year. Teagle's counts made in 1958 and 1959 are set out in Table 1. In 1960 his peak count was 115 on 30 August.

From 1964–6, mallard numbers on the lake were peaking in the autumn and winter at 160 in 1964, 120 in 1965 and 150 in 1966 (Grant). Taken altogether, the counts made from 1946–66 show how the wintering population has fluctuated, depending upon the condition of the lake. The resident population continued to be supplemented by autumn arrivals: on 7 November 1997, for instance, more than 50 were present, but there was no autumn influx in 1998 or 1999 when the lake had to be drained and cleaned (Brown 1998, 1999, 2000). Grant estimated that about 25 pairs bred in the Park from 1965–7, producing up to 100 ducklings each year, of which less than a third achieved maturity. The breeding population has declined since then and few ducklings survive (Brown 2000).

Mallard in Greenwich Park often nest in old trees, using holes in the trunks of ancient sweet chestnuts, hollows in their broad branches 1.5 to 4.3 metres (5 to 14 feet) above ground, and even high up on the tops of lopped oaks and sweet chestnuts. Other sites have included a hayrack and on the ground among brambles, bracken and bluebells, often at the base of a tree. Clutches of up to 13 eggs used to be found, although 7–10 were more usual.

TABLE 1. Winter censuses by W.G. Teagle of selected bird species in Greenwich Park in 1958 and 1959. (Note: NC = no count made).

	1958															1959			
	26/1	**1/2**	**9/2**	**14/2**	**22/2**	**5/3**	**9/3**	**17/3**	**23/3**	**31/3**	**22/11**	**30/11**	**7/12**	**17/12**	**21/12**	**3/1**	**11/1**	**25/1**	**15/2**
Mallard	51	55	73	71	60	70	50	74	53	41	60	14	46	51	42	51	45	56	44
Moorhen	2	4	5	4	5	3	4	1	4	3	8	4	3	3	2	6	3	3	4
Common gull	62	11	131	–	20	–	16	78	57	NC	5	7	17	3	7	32	4	47	2
Stock dove	–	–	9	2	4	1	3	10	23	18	–	–	–	1	19	20	3	12	19
Woodpigeon	108	168	134	117	109	165	148	130	120	169	73	30	54	53	61	97	53	54	82
Pied wagtail	–	–	–	3	1	–	–	2	1	4	–	1	–	1	–	3	–	–	–
Wren	2	2	3	2	1	4	2	2	–	1	5	2	4	4	–	1	2	3	–
Dunnock	9	5	3	3	14	3	7	6	10	10	13	5	7	2	6	10	7	4	8
Robin	7	11	11	13	12	12	5	5	11	18	10	9	9	13	12	5	6	13	16
Blackbird	51	54	50	33	59	56	42	54	50	62	102	70	73	78	52	99	54	72	61
Song thrush	11	10	13	6	15	4	6	8	8	11	5	5	11	19	9	16	6	8	11
Redwing	13	6	1	4	2	–	2	1	–	–	–	–	–	–	–	–	1	4	–
Mistle thrush	2	5	1	5	4	3	1	3	1	9	5	3	4	2	8	4	3	2	8
Coal tit	–	–	–	–	2	2	2	3	–	1	–	–	–	2	1	–	–	1	1
Blue tit	12	19	30	24	37	21	48	18	16	15	11	4	6	9	12	20	12	16	10
Great tit	11	4	11	4	8	5	5	4	7	6	5	2	3	4	7	9	4	8	6
Jay	6	7	9	3	5	3	5	4	6	7	5	7	8	4	7	9	7	5	6
Jackdaw	7	9	11	3	1	2	5	9	10	10	–	9	8	16	7	12	9	24	12
Carrion crow	6	8	5	5	4	7	6	4	9	4	5	4	2	6	2	8	5	9	5
Starling	378	66	183	184	57	93	47	235	105	293	NC	131	88	139	96	224	40	82	96
House sparrow	96	138	135	117	121	147	139	110	190	192	NC	123	108	189	120	157	105	130	139
Chaffinch	3	4	2	3	7	7	5	9	6	8	5	3	6	5	8	5	4	3	6
Greenfinch	–	1	–	–	–	–	–	6	5	4	3	–	1	1	1	–	–	–	–
Bullfinch	–	–	–	–	–	–	–	–	–	–	4	6	2	1	1	2	5	2	–

Mallard seem to have been relatively uncommon on the Blackheath ponds and breeding records there are even rarer, although the GNHC described the species as 'formerly not uncommon in the district'. It was mentioned as a non-breeding bird in the 1920s and 1930s by Rendall, while in 1937 a pair reared three young at Prince of Wales Pond (Barclay-Smith); the ducklings were undisturbed by the model yachts being sailed there, even perching on one and preening as they sailed along! A pair probably bred regularly in the 1940s at the secluded Round Pond, where I saw three drakes swimming amongst the duckweed on 22 April 1947.

Owen, Teagle and I quite often saw a few mallard using Folly Pond, close to Greenwich Park, in the 1940s and 1950s. Broods of ducklings were occasionally to be seen there and were presumed to have hatched in the Park and crossed to the pond during the early hours when road traffic was at its minimum. Mallard were also seen from time to time in the 1950s on Hare and Billet Pond, where ducklings were seen in 1956, and on Prince of Wales Pond (Teagle 1997). Mallard have bred near the latter once or twice in recent years (Brown pers. comm.).

Pintail *A. acuta*: one which had arrived on the ornamental lake in Greenwich Park a few years previously, apparently under its own power, had settled in permanently and was still there in 1929 (Barclay-Smith). Later, pinioned pintails were occasionally introduced. On 17 November 1966 an apparently wild adult male and an immature male appeared on the Park lake and visited it regularly up to the end of that year (Grant).

Garganey *A. querquedula*: a report of 18 December 1937 noted that four or five years previously an apparently wild drake was seen on the lake in Greenwich Park (Blandford 1937).

Shoveler *A. clypeata*: An apparently wild female was seen in Greenwich Park on most dates between 25 August and 5 September 1966 (Grant).

Pochard *Aythya ferina*: pinioned birds have been released on Greenwich Park's lake from time to time. A possibly wild pochard there was a female seen by Teagle on 12 January 1958 and on several other dates up to 23 March that year. In 1969, apparently wild birds flew over the Park (Grant 1971).

Tufted duck *A. fuligula*: the first record in Greenwich Park was of one (sex unrecorded) which arrived on the lake on 16 July 1931 but was killed by the resident mute swans (Barclay-Smith). Next year a pair appeared in May and stayed about two weeks. The female of this pair probably deposited an egg in a mallard's nest as a tufted duckling was seen in a family group of mallards in July and last seen, keeping company with mallards, on 16 October 1932. In 1933, wild birds visited the lake at intervals (Barclay-Smith). In 1935, four pinioned pairs of tufted ducks (introduced the previous year) were joined on 5 March by three wild birds which stayed for more than a week. Next year, two wild drakes and a duck stayed about ten days on the lake in February, and on 22 March 1937 three wild drakes arrived and remained for a fortnight. On 14 February 1938 a drake was found dead on the lake and the four pinioned pairs all perished when the lake was frozen and 30 centimetres (12 inches) of snow covered the ground (Barclay-Smith).

I occasionally saw single wild tufted ducks on the lake in Greenwich Park in the winters of 1944–5 and 1945–6, and Holroyde saw a drake on 8 December 1948. A pinioned pair was introduced in the mid 1950s and bred. No more wild birds were seen until 11 May 1957, when Teagle saw four fully winged birds (three drakes and a duck) which joined the pinioned pair and the surviving young female. In November 1958, the only survivor of these last three, a drake, was joined by a newly released pinioned pair. Next month they were joined by an apparently wild female which disappeared by 11 January 1959. The new pinioned pair survived at least till the end of August 1960. On five dates from 6 March to 14 August 1960 this pair was accompanied by another, presumably wild, drake (Teagle unpub. notes).

Grant recorded three fully winged tufted ducks in Greenwich Park during 1965 and four during 1966. On 4 September 1975 I noted that 'several' were present on the lake, a year when breeding was reported (*BLRP* 1975). Since the condition of the Thames was vastly improved, tufted ducks can be seen in flocks there and more visit the Park lake in winter. The maximum count in 1997 was more than 40 adult drakes late in February. In the following winter they peaked at 25–30 drakes early in February, but fell to seven by the end of the month. In the winter of 1998–9 numbers rose briefly to about 20 in mid January. Pinioned birds are present and a few breed (Brown 1998, 1999).

On the Blackheath ponds, Hyatt saw a female tufted duck on the Prince of Wales Pond on 12 March 1954 (Teagle 1998). Nowadays, pairs are occasionally seen there (Brown pers. comm.).

Common scoter *Melanitta nigra*: an oiled female appeared on the Greenwich Park lake on 21 February 1966 and died soon afterwards (Grant).

Goldeneye *Bucephala clangula*: I saw a female consorting with five teal and the mallard on the Greenwich Park lake one day in December 1944.

Red-breasted merganser *Mergus serrator*: a first winter-drake was found dead by the lake in Greenwich Park on 16 February 1956, during a cold spell (Phillips and Manser 1957).

Hen harrier *Circus cyaneus*: at 08.45 GMT on 10 December 1946, Owen (unpub. journal) saw a brown ringtail harrier, which he considered to be a hen harrier, rise from the ground near a flock of gulls on Blackheath and circle up to a 'fair height' before disappearing northwards towards Greenwich and the Thames.

Sparrowhawk *Accipiter nisus*: recorded in the Blackheath district in the nineteenth century (GNHC and Witherby). From 1896–1901 Webster considered it to be an occasional visitor to Greenwich Park. From 1943 I quite often saw this hawk at Blackheath and in Greenwich Park. Later the Park Superintendent told me that a pair had nested successfully in 1944 and 1945 in an old oak in the enclosed Large Bird Sanctuary, which I had been unable to explore. In 1946, when I had received permission to enter them, I frequently saw sparrowhawks in the Wilderness and the adjacent bird sanctuaries, including a pair which circled, calling, above the trees on 30 April. At least one was present from then until at least mid July. I eventually visited the old nest site in an oak in the Large Sanctuary, but it was not used that year; they probably bred in another site which I failed to find. They may well have nested in 1947 and 1948, again undetected. In 1948 I found the regular plucking place on 10 May under an old chestnut tree in the Large Sanctuary; that and subsequent visits revealed the remains of many kills, mostly of house sparrows.

In 1949 a pair returned to the old nest in the oak in the Large Sanctuary: Owen and I discovered a clutch of five eggs on 2 June, the female flying off as we began to climb the tree (Owen and Burton 1950). All the eggs hatched by 16 June and four young (two males and two females) successfully left the nest on 14 July, having been ringed by Owen on 5 July. One of them was found dead at Blackheath Village two months later, having apparently flown into telegraph wires.

In 1950 a much smaller nest was built in a birch, close to the 1949 oak nest site; it contained four eggs on 13 May. The young apparently fledged successfully. In 1951, a pair at first behaved as if they would use the 1950 nest (I flushed a male from it on 26 March), but they eventually built a new nest some six metres (20 feet) up in an oak in the Middle Sanctuary. On 1 July 1951 I climbed to it and found a nestling about a week old, which I ringed, and three apparently infertile eggs. The nestling fledged successfully in late July, but was found long dead seventeen miles (27 km) away at Meopham, Kent, on 2 October 1952 (Burton and Hyatt 1953). The chosen new nest site in the Park in 1952 was a birch tree close to the northern fence of the Large Sanctuary. It was discovered too late to know if they bred successfully (Burton and Hyatt 1953) but the large number of bird kills at plucking places suggested that there had been young. In late April 1953 the sparrowhawks began to build yet another new nest, near the top of a tall hawthorn in the Middle Sanctuary. On 9 May this contained a single egg, but it disappeared soon afterwards and I found the broken shell beneath the nest on 16 May. The pair then began a second nest in a nearby oak, the one used in 1951, but apparently failed to use it this time (Burton and Hyatt 1955). A pair tried unsuccessfully to breed in both 1954 and 1955 (Brown and Phillips 1955, Phillips and Manser 1957). The 1954 nest was in the birch tree used in 1952 and had two eggs on 20 June (Teagle unpub. notes). In 1955 a nest found on 14 May contained one egg, but this had disappeared by the 21st and the adults were not seen again.

Records from the 1960s and 1970s are sparse: one in the Wilderness on 4 July 1965 (Grant 1967); a female on a fence in late April 1968 (Grant 1970); one in the Park on 14 April 1971 (*LBR* **36**: 21); and one seen by the Superintendent, J.A. Murray, on 1 and 16 March 1975 (*LBR* **40**: 24). Nowadays, however, it is not unusual to see one flying over Greenwich Park and breeding occurs not far outside its walls (Brown 1999, Paice and Glaves 1997).

Between 10 May 1948 and 2 May 1953, Hyatt, Owen and I recorded the following prey items at sparrowhawk plucking places in Greenwich Park: feral rock dove (including two ringed racing pigeons, traced to owners in NW London and Guildford), stock dove, woodpigeon, great spotted woodpecker, robin, blackbird, song thrush, great tit, starling, house sparrow, chaffinch and greenfinch. House sparrows were much the most numerous; on one day, 7 July 1951, I found the heads and other remains of ten (four males and six females) at a plucking place about 14 metres (15 yards) from the nest to which, a little later, I saw the male fly with a headless house sparrow. Next most numerous were starlings, blackbirds, robins, woodpigeons and greenfinches. House sparrows were then very numerous so it is not surprising that they figured so prominently in the sparrowhawks' diet. As well as these species, Owen witnessed an unsuccessful attack on a jay by a female sparrowhawk on 28 May 1949 and Hyatt, Owen and I all saw unsuccessful pursuits by both sexes of woodpigeons and feral rock doves in the Park, especially in October and November, when large numbers of woodpigeons gathered in the Wilderness. This was also noticed in recent Octobers by Paice and Glaves (1997).

The sparrowhawks breeding in Greenwich Park also hunted over Blackheath. Sightings at Blackheath included one I saw fly from a tree by The Paragon on 15 December 1946; singletons seen by Hyatt over Kidbrooke Gardens on 7 January 1950, 23 August 1952 (chasing a great spotted woodpecker) and 15 November 1952; and one which flew close to him in fog by The Paragon on 17 December 1958. Teagle (1997) recorded birds over the Heath on 31 January, 3 May and 11 May 1954.

Kestrel *Falco tinnunculus*: recorded from Blackheath in the nineteenth century (GNHC and Witherby) and as an occasional visitor to Greenwich Park around 1900 (Webster). It is listed for Blackheath in the 1920s and 1930s, but not as a breeding species (Rendall). In the 1940s and 1950s, a kestrel hovering over parts of the Heath, where coarse vegetation on the wartime rubble-filled gravel-pits harboured a good population of small rodents and skylarks, was an almost daily sight. They often flew into the shelter of Greenwich Park's Wilderness to eat their captures. Owen and I often found skulls of field voles and woodmice in kestrel pellets on Blackheath and in the Park. Although we never searched hard for breeding sites, in the late 1940s Owen and I found evidence of breeding on tall buildings around the edge of the Heath, such as Vanbrugh Castle and on St Margaret's and St Michael's Churches.

Grant strongly suspected kestrels of breeding locally in 1966. Between August and December from 1964 to 1966 from four to six birds at a time hunted over Greenwich Park. In 1967 breeding was reported at Blackheath and another pair probably nested on the Royal Naval College, close to the north side of Greenwich Park (Montier 1968) and in the Park area in 1969 (Grant 1970). A pair nested, apparently successfully, on Vanbrugh Castle in both 1995 and 1996 (Paice and Glaves 1997), while in 1996–8 a pair bred in the Wilderness, successfully rearing three young in the first two years, but only one in 1998 (Brown 1998, 1999). In 1999 they failed to breed and, indeed, were rarely seen in the Park (Brown 2000).

Merlin *F. columbarius*: one flew north over General Wolfe's statue in Greenwich Park on 29 January 1966 (Grant).

Hobby *F. subbuteo*: one flew over Greenwich Park on 26 September 1999 during a movement of hirundines and another flew west on 17 May 2000 (Brown 2000, 2001).

Pheasant *Phasianus colchicus*: stated by Witherby (1895) to be a rare visitor to the Blackheath district.

Red-legged partridge *Alectoris rufa*: reported in 1859 by the GNHC to occur 'occasionally' at Blackheath, it must have disappeared from the area well before the end of that century.

Grey partridge *Perdix perdix*: reported by the GNHC in 1859 to have formerly occurred at Blackheath, though in 1895 Witherby reported it to be a rare visitor and it was recorded occasionally around 1900 at nearby Lee (Grinling) and was seen once in Greenwich Park about this time by Webster.

Quail *Coturnix coturnix*: this summer visitor was recorded occasionally in the Blackheath area (e.g. Kidbrooke) in the early nineteenth century (GNHC) where Witherby said that once it came annually, and in Greenwich Park during 1896 to 1901 (Webster).

Water rail *Rallus aquaticus*: this crake was reported by the GNHC to have occurred in the Blackheath district in the early nineteenth century.

Corncrake *Crex crex*: relatively common up to the early 1900s in southern England, so it is not surprising that it was found at Blackheath in the nineteenth century (GNHC), and it was still to be heard at nearby Lee around 1900, and had been seen once in Greenwich Park during 1896–1901 (Webster).

Moorhen *Gallinula chloropus*: in 1859 the GNHC reported that the moorhen formerly bred at the Blackheath ponds. Witherby stated that it 'breeds every year in Blackheath Park and elsewhere', and Rendall included it on his Blackheath list for the 1920s and 1930s. A pair probably bred, at least in 1946 and 1947, on the secluded Round Pond which no longer exists. It is listed as breeding in Greenwich Park from 1896–1901 (Webster) and at least a pair has been present on the Park's lake from at least 1928, rearing one or two broods annually in the 1930s (Barclay-Smith). A gap occurred in 1950 when the poor state of the lake drove the resident birds away. They were back by March 1951 and the lake has held its moorhens since then, apart from a brief period when more improvement work was done after the 1954 breeding season. They returned when the lake was reflooded before the 1955 breeding season. Checks by Teagle in the winter months of 1958 and early 1959 (Table 1) showed three or four birds present on most dates, and occasionally up to eight. He noted seven adults and one juvenile on 8 November 1959. By March 1961 he was counting at least six, possibly as many as nine, on or around the lake.

I had considered that one pair of moorhens was all that the Park lake could comfortably support, so I was astonished that five or six pairs bred there in 1965 and 1966 (Grant), although 'very few fully grown young' were raised, 'suggesting that the population was at its capacity for such a small area of water.' On 28 July 1971, 5 June 1974, 4 September 1975 and 30 August 1983 I noted at least three birds on the lake on each occasion. In 1996 at least one pair bred in the Park (*LBR* 61: 68). In 1997–9 two or three pairs bred each year, some having more than one brood, but only four to six young survived each year (Brown 1998, 1999, 2000).

Coot *Fulica atra*: a single bird seen on the Greenwich Park lake on 26 May 1962 (Teagle et al. 1964) seems to have been the first recorded in the area. Another was there on 12 May 1964 (Tinning et al. 1966) and in 1965 one was on the lake from 6 July to 12 September (Grant 1967). In 1968 one stayed on the lake for six days in March (Grant 1970). In 1969 a pair appeared during May (Grant 1971). Since then a coot or two have been present in Greenwich Park most years. Early in 1997, in hard weather, two birds joined the single resident (which had a damaged wing) and one of them stayed. Two young hatched early in April but lived only a day or two. Two more hatched late in May and one survived but was not seen after 21 September. In 1998, two pairs bred (one pair twice) but no young were raised. In 1999 two pairs had three broods and two of the last brood survived (Brown 1998, 1999, 2000). I know of no records of coots from the Blackheath ponds.

Oystercatcher *Haematopus ostralegus*: one flew north over Greenwich Park on 26 July 1968 (Grant 1970).

Ringed plover *Charadrius hiaticula*: one flew over Greenwich Park on 26 September 1999 (Brown 2000).

Golden plover *Pluvialis apricaria*: recorded as a visitor to Greenwich Park during 1896–1901 (Webster), presumably flying over in winter. I watched two fly northwards over Blackheath on 22 December 1946; at one point they flew low as if to land, but instead continued on their way.

Lapwing *Vanellus vanellus*: reported by the GNHC as a regular visitor to Blackheath in the mid nineteenth century and by Webster to Greenwich Park during 1896–1901, presumably usually flying over. In December 1945 I saw a few stop briefly one morning to feed in the northern part of the Park. On 4 November 1955, about 60 were watched flying north-west (Phillips and Manser 1957). On 26 January 1957, a lapwing alighted for about a minute on Blackheath (Teagle 1997).

From the end of September 1964 to November 1966, Grant was more systematic in looking out for lapwings: he noted westerly movements over Blackheath and Greenwich Park with particularly high numbers, up to 247, in July 1966. Records since then are sparse. One observer recalls a few sightings in the 1970s and 1980s of single birds or small groups, usually in February and July. Most recently, in 1997, one flew north over Greenwich Park in April and others in October. In June 1999 one flew west across Blackheath (Brown 1998 and pers. comm.).

Snipe *Gallinago gallinago*: stated by Witherby in 1895 to be a rare visitor to streams at Kidbrooke. One was seen by F. E. Birch, the Greenwich Park Superintendent, to fly in over the trees and land on the ice-covered lake in the Park about 15.30 on 30 January 1947. It soon took off and circled the lake twice before flying north. On 26 March 1965, Grant flushed one in the Park's Wilderness.

Woodcock *Scolopax rusticola*: recorded by the GNHC on Blackheath in the mid nineteenth century and by Webster once in Greenwich Park during 1896–1901.

Subsequent records are: one flushed in the Wilderness, Greenwich Park, on 13 November 1952; one in the same place and the nearby part of Blackheath in January and February 1954 (Brown and Phillips 1955, Gault 1955, Teagle 1997); one flushed from a Greenwich Park bird sanctuary on 2 April 1955 (Phillips and Manser 1957); one there on 19 October 1958 (Teagle and Teagle 1959); one in the Wilderness on 14 February 1959 (Teagle and Burton 1962); one picked up near the boating pool in the north part of the Park on 1 January 1963 which died (Tinning et al. 1966); one flushed by Grant (1967) in the Wilderness on 22 March 1965 and another put up from there on 30 October 1967 by the Park Superintendent (Grant 1970). Recently, one was in a garden at Blackheath on 4 November 1998 (LNHS *Orn. Bull.* **241**) and one flew into Greenwich Park from the west on 23 November 1998 (Brown 1999).

Black-tailed godwit *Limosa limosa*: ten, driven down by turbulent weather, fed on Blackheath on 18 August 1999 (LNHS *Orn. Bull.* **245**).

Curlew *Numenius arquata*: one called over Blackheath Park on 20 August 1955 (Teagle 1997); one flew west high over Greenwich Park on 30 October 1964; one fed with gulls on Blackheath at 07.30 on 12 February 1966 (Grant); and one flew over Greenwich Park on 13 March 1999 (Brown 2000).

Redshank *Tringa totanus*: two were seen by Owen on 3 May 1951 calling high over Blackheath, having flown over Greenwich Park.

Green sandpiper *T. ochropus*: Grant saw one by the lake in Greenwich Park on 2 October 1964.

Common sandpiper *Actitis hypoleucos*: in the mid nineteenth century this species was reported from the Blackheath ponds by the GNHC. For a short time from 13.40 on 12 May 1947, Owen, Hyatt and I watched two flying around the lake in Greenwich Park and occasionally alighting. Teagle watched one there on 2 August 1954 — not 2 May as reported in Brown and Phillips (1955). Grant recorded single birds on 7 May and 18 August 1965, and 9 May 1966. One was flushed by the Park's boating pool on 19 August 1998 and flew towards the Thames (Brown 1999).

Turnstone *Arenaria interpres*: one fed undisturbed by busy traffic near the A2 roundabout (Camomile Bottom) on Blackheath at 07.20 on 21 August 1999 (LNHS *Orn. Bull.* 245).

Mediterranean gull *Larus melanocephalus*: one, age unspecified, was seen in Greenwich Park on 18 December 1997 (*LBR* 62: 95).

Black-headed gull *L. ridibundus*: towards the end of the nineteenth century this species began to winter in the London area in large and increasing numbers and was described as 'common' by B.W. Adkin (Grinling). Webster became used to seeing gulls flying overhead at Greenwich Park, but clearly had difficulty in distinguishing between the species, hence his inclusion of 'Black-backed gull' and 'Sea Gull.' in his 1896–1901 list.

By 1929, Barclay-Smith was reporting: 'Either owing to the cold winter, or to the fact that in the spring of 1929 the Greenwich Borough Council instituted in Kidbrook (*sic.*) Fields a large rubbish dump which attracted gulls in hundreds, the Black-headed Gull has "discovered" Blackheath. The birds have appeared this winter, frequently being seen flying over the (Greenwich) Park, and walking about the heath, just outside the gates.' In 1934 she wrote that they and common gulls were now regular visitors to the Heath just outside the Park and congregated there in large numbers in the early spring.

By 1943 they were indeed well established winter visitors on Blackheath. For example, on 11 March 1944, I wrote in my journal that 'a flock of common and black-headed gulls were to be seen, also several rooks' on the flat grassland. From then on I recorded 'many' on Blackheath, noting, for example, from 10–12 March 1947, towards the end of a notoriously severe winter, large numbers of both gull species flying east and north all day 'in great companies across the sky at a great height'. They flew over Greenwich Park in considerable numbers from October to April in the 1940s and 1950s, some occasionally alighting on the lake or open grassy areas. Sometimes, a few were seen in other months. This pattern continued to 1960 with black-headed gulls usually less numerous than common gulls on Blackheath (Teagle 1997). My maximum count was 63 black-headed with 374 common gulls on Lincoln Field on 13 February 1958. In the 1950s they seemed to arrive earlier (e.g. August) and stay later (April).

Grant made almost daily early morning counts from 1964–6 of the gulls congregating on Blackheath but published only the actual numbers he recorded for herring gull and great black-backed gull. He may have intended to publish details of all species later, but been prevented by his untimely death. On 4 September 1975 and 30 August 1983, I saw many black-headed gulls with common gulls on the usual areas of short grassland. Nowadays, black-headed gulls are normally present from July to March, although a few may be present at other times, and continue to commute between the open Heath or country feeding areas and the roosts on the River Thames. Greenwich Park's lake is a popular resort and, at times, more than a hundred congregate there (Brown 1998).

Ring-billed gull *L. delawarensis*: this North American gull is becoming a more frequent visitor to the British Isles, but is still rare in the London area. An adult was discovered in Greenwich Park in July 1997, frequenting the grassland south of the Queen's House. It was seen again on 17 August, 30 October and 4 December that year (*LBR* **62**: 97, Brown 1998). On 9 March, 1998 one appeared and was seen from 20–24 March 1998 (Brown 1999). This or another was in Greenwich Park and on Blackheath from late February to 18 March 1999 (Brown 1998, 1999, 2000, LNHS *Orn. Bull.* **243**)

Common gull *L. canus*: the GNHC reported common gulls in winter on Blackheath and on the Thames at Greenwich. About 1900, B.W. Adkin (in Grinling) considered them common winter visitors to Greenwich, but many ornithologists at that time found them difficult to distinguish in the field (Fitter 1949*a*). References to large flocks of 'Herring Gulls' on Blackheath appear in Greenwich Park reports for the years 1931–8 (Barclay-Smith) but it seems certain that they were, in fact, common gulls. By the end of this period they were noted arriving 'as early as the latter part of August,' and in 1938 birds appeared at the beginning of July and 'each year were remaining for longer periods in the vicinity of the Park'.

On 11 March 1944, I noted common gulls flocking on the short grassland at Blackheath with black-headed gulls. Thereafter, I often noted large numbers visiting the Heath in winter. In the severe winter of 1946/7, I observed many feeding with black-headed gulls in the snow on 19 and 22 December. As mentioned under that species, after the great thaw of 9 and 10 March, I recorded large numbers of both species flying east and north throughout daylight from 10–12 March. In 1953 Teagle (1997) began systematic early morning counts. Common gulls still frequent Blackheath: 100, for instance, were counted on 21 February 1997 (*LBR* **62**: 99). As in the past, some appear in or over Greenwich Park as they move to and from the Thames. Most are reported in March, April, August and September, sometimes alighting to feed on the Ranger's Field or their favourite area south of the Queen's House (Brown 1998, 1999, 2000).

Lesser black-backed gull *L. fuscus*: Webster recorded 'Black-backed Gulls', presumably this species, as visitors to Greenwich Park during 1896–1901. No doubt they flew over on passage. I saw them quite regularly during 1946–53, especially on Blackheath. From 1953–61 they were seen in every month, but until autumn 1956 only in small numbers. On 12 September 1956, a gathering of 40–50 was seen and such numbers then became commonplace on Blackheath (Teagle 1997). On 24 August 1958, Hyatt and I saw more than 100. Between 28 August and 26 October that year Teagle (1997) counted 72–182 on several dates. From 1958–60 Teagle also observed them flying over Greenwich Park, usually ones and twos, but occasionally up to a dozen or more from August to October. Occasionally too, some alighted, usually to join black-headed and common gulls in the more open northern parts of the Park. Grant saw the same in the mid 1960s. Nowadays a few appear irregularly in Greenwich Park, usually in spring and from July to September.

Herring gull *L. argentatus*: from the winter of 1943–4 to 1953 I knew this gull only as an irregular visitor to Blackheath and Greenwich Park, most often in winter and usually singly. In 1947, Owen saw two on 4 May; and with Hyatt, one on 6 May ; three on 18 June and two on 10 July — all flying low over the Heath: the only late spring–summer records I know. One in Greenwich Park in September 1969 was the first for this month in the Park since at least 1964 (Grant 1971). Three on the Ranger's Field in the Park on 20 March 1997 was described as unusual. The next year, however, up to four occasionally landed on the Ranger's Field (Brown 1998, 1999).

Iceland gull *L. glaucoides*: an immature was seen on 6 February 1957 near the Greenwich War Memorial on Blackheath (*LBR* **22**: 21, Teagle 1997).

Great black-backed gull *L. marinus*: my only sighting in the area was six flying east over Greenwich Park on 22 April 1953. In 1957, an oiled adult was present on Blackheath on 6 February and on 24 September an immature was with many lesser black-backed gulls (Teagle 1997). Grant listed six records between September 1964 and November 1966, the most being six with the gull flocks on Blackheath on 12 October 1964.

Sandwich tern *Sterna sandvicensis*: on 3 September 1996 two flew up from a party of gulls on Blackheath (*LBR* **61**: 96).

Common tern *S. hirundo*: since a recent reduction in the level of its pollution, terns are more often seen in the upper reaches of the Thames than previously and nowadays a few common terns breed in nearby Docklands; therefore, it is not surprising that two were seen flying over Greenwich Park on 18 June 1999 (Brown 2000).

Feral rock dove *Columba livia*: like many ornithologists of my generation I did not pay much attention to feral pigeons. From my first visit to Greenwich Park in 1943 I was aware that a good many were present around the ornamental lake, where visitors threw food for the ducks, and many more in the northern part where they were also fed by people. They were numerous also on Blackheath, sometimes acccompanying woodpigeons.

On 28 March 1953, Derek Goodwin (a world authority on pigeons) and I watched about 30 by the Park lake, observing that some of them were of the blue and red chequer forms. In 1958, Teagle's (unpub. notes) maximum count for the Park that year was 105. Swarms around picnicking families, as I saw by Wolfe's statue on 28 July 1971, continue to be a frequent sight in the Park, where they gather in hundreds around the lake, extending into the adjacent areas (Brown 2000). Judging by my occasional visits to Greenwich Park in 1971, 1975, 1983 and May 2000, I would say that feral pigeons have much increased since the 1950s.

In the past I never noted the nesting sites of feral rock doves here, but assumed that they nested on such prominent buildings as churches and on the old houses around Blackheath and Greenwich Park. However, they have recently been recorded nesting in old trees in Greenwich Park (Brown 1999, 2000), and Patricia Brown and I watched one inspecting a large hole in a sweet chestnut tree on 8 May 2000.

Stock dove *C. oenas*: mentioned by the GNHC and by Witherby as an inhabitant of the Blackheath area. It was listed by Webster (1902) as breeding in Greenwich Park during 1896–1901, where the numerous holes in the ancient trees provide suitable nest sites. From 1943–52 I estimated about three breeding pairs in most years. In 1953 I made more effort to locate nests and found four probably nesting pairs in One Tree Hill area alone, plus others elsewhere in the Park, making a total breeding population of at least ten pairs. On 28 March 1954, Teagle (unpub. notes) found at least three pairs in the trees of Bower Avenue and another pair in the Flower Gardens, plus a singing male in the Wilderness.

Detailed observations throughout 1958 suggested that as many as twenty-one pairs of stock doves may have attempted to breed in Greenwich Park, and early in 1959 a survey indicated that a similar number were preparing to nest. In 1960 up to eleven possible breeding pairs were identified (Teagle unpub. notes). These later surveys and my own greater effort in 1953 suggest that the pre-1958 estimates were too low. However, the breeding population in the Park has undoubtedly fluctuated over the years, as it has nationally. In 1963 only a single pair was known to have bred and none in 1964 (Tinning et al. 1966). In the 1965 and 1966 breeding seasons Grant (1967) found only four pairs present in the first year and three pairs in the second. In 1967 two pairs nested; the following year there were five breeding pairs and in 1969 at least two pairs bred (Grant 1970).

Grant (1967) mentioned that in the mid 1960s he never observed stock doves feeding in the Park. I saw up to 15, presumably from the resident population, feeding with woodpigeons on the acorns in the Wilderness on 8 October 1949 and several again on 21 September 1952. I saw stock doves in the Park throughout the year in the 1940s and 1950s with estimates of up to about 25 daily. Winter counts in 1958 and 1959 (Table 1) showed highest numbers in the order of 18–23 birds. I sometimes saw stock doves around Morden College and The Paragon at Blackheath, as did Teagle (1997), and on 2 October 1949 watched a mixed flock of them and woodpigeons feeding on ploughed ground on the Heath, close to the Greenwich Park wall.

During a brief walk through Greenwich Park on 28 July 1971, I noted several stock doves in the trees between One Tree Hill and Observatory Hill. As late as 1975 they were recorded as still breeding in the Park, or probably doing so (*BLRP* 1975), but there is no recent evidence of this. However, they continue to occur on occasions: for instance, 150 were counted on 29 November 1997, but soon left (*LBR* **62**: 108) and a few frequented the deer enclosure and the vicinity of Queen Elizabeth's Oak in 1998 and 1999 (Brown 1999, 2000).

Woodpigeon *C. palumbus*: this has probably always been a more or less common breeding species in Greenwich Park, although there is usually a large non-breeding population. I usually found up to a dozen nests annually without much searching, but suspect that Grant's estimate of *c.*50 pairs breeding in the whole of the Park in 1965 and 1966 was perhaps too high; I believe 25–30 pairs, the probable annual total in most years in the 1940s and 1950s, would have been more accurate.

Outside the breeding season, the number of woodpigeons present in Greenwich Park varies considerably and erratically (see Table 1). From the middle of September to early December, large numbers feed on the acorn crop. They have also been seen consuming *Pyracantha* berries and snowberries *Symphoricarpos albus* and joining in the scramble for food scraps deposited by human visitors. In the autumns of 1997 and 1998 many flew westwards over Greenwich Park and Blackheath. For example, in November 1998, more than 560 flew over Blackheath on 6 November and 480 on the 11th (LNHS *Orn. Bull.* 241). Teagle (1997) gave details of some of the large flocks of woodpigeons, sometimes up to 200 in number, feeding on Blackheath from 1954 to 1957. As a breeding species, woodpigeons were said in 1895 by Witherby to be increasing rapidly and nested in large gardens around the fringes of Blackheath in the 1890s, as in the 1920s and 1930s (Rendall), through to the 1960s, and probably still do so.

Collared dove *Streptopelia decaocto*: this dove was not known to breed in Britain until 1955 and did not reach the London area until several years later. Two seen briefly in Greenwich Park's Flower Gardens on 29 March 1965 appear to have been the first for this area and another was there in April 1969 (Grant 1967, 1971). On 29–31 August 1983, Owen and I noticed a few frequenting the large gardens on the periphery of Blackheath, but none in Greenwich Park. A few are nowadays seen in or over Greenwich Park, although the maximum count in a single day since 1996 has been only three. One bird in the Park in 1997 was seen carrying nesting material on 12 December (*LBR* **62**: 109).

Turtle dove *S. turtur*: bred in the Blackheath area in the mid nineteenth century (GNHC) and still did so in Greenwich Park during 1896–1901 (Webster). In 1944, I found the last pair known to breed in the Park and it was not reported again until 1955 when one was seen feeding with feral rock doves near the Park's St Mary's Gate on 14 May (Phillips and Manser 1957). Almost a decade later one was encountered in the Park on 5 May 1964 (Tinning et al. 1966). Then Grant (1967) demonstrated that a persistent lookout for migrants at the appropriate times could be productive: in May 1965 he saw sixteen individuals fly over Greenwich Park and another eight resting there. In 1966, however, he saw only singles in May: on the 11th and 17th, and had one autumn record, one flying west on 6 September 1966. In 1969 one flew over the Park in August and another in September (Grant 1971). Much more recently, singles were seen feeding in Greenwich Park on 9 May and 2 June 1997 (Brown 1998). Next year one appeared in the Deer Enclosure on 17 May (Brown 1999). In 1999, up to two turtle doves were seen in the Park from 9–12 May and singletons on 6, 26 and 27 September, and one at Blackheath on 8 June (LNHS *Orn. Bull.* **244** and **246**).

Ring-necked (or **rose-ringed**) **parakeet** *Psittacula krameri*: as strong feral populations have become established not far away in recent years, it was inevitable that sooner or later it would spread to the Greenwich area. In 1998 three were seen together in Greenwich Park (Brown 1999). In 1999 a flock of 11 appeared there in early June (LNHS *Orn. Bull.* **244**) and from mid September up to 10 or more, though usually about five, mostly sub-adults, were present daily (Brown 2000).

Cuckoo *Cuculus canorus*: a regular visitor to Blackheath and Greenwich Park at the end of the nineteenth century (Webster, Witherby), and still so in the 1940s and 1950s. They were most often seen or heard there in May, but also in the latter half of April and the first week of June. Presumably, females which stayed for a week or more may have found suitable nests in which to deposit their eggs, such as the one that stayed in the Wilderness area in late May–June 1948, but I never found a parasitized nest or heard of anyone else doing so.

My earliest date for a cuckoo in Greenwich Park is 15 April (1950), the latest, 15 June (1948). In 1965 and 1966, Grant recorded a total of three birds during April, four during May and three in June, the latest on 14 June (1965). One heard on 4 June 1997 was moving southwards (Brown 1998) and next year one was observed near the Wolfe statue on 7 May (Brown 1999). I occasionally heard cuckoos at Blackheath in the 1940s, such as in the grounds of Morden College, where Teagle (1997) noted them in the springs of 1953, 1954, 1956 and 1957.

Barn owl *Tyto alba*: this was the only owl in the 1896–1901 list of the breeding birds of Greenwich Park (Webster). It was seen in the Park in both 1928 and 1929, but not known to have nested (Barclay-Smith). The then Park Superintendent, F.E. Birch, told me that a pair bred at least once in an old barn in the Paddock (since demolished) prior to 1943, but they were not subsequently seen. At Blackheath Witherby often heard the barn owl at night and several times saw it flying in the evening; it also appeared, as a non-breeder, in a list of birds for 1912–37 (Rendall).

Little owl *Athene noctua*: by the early 1900s this owl was spreading into the outskirts of London from the major introduction site at Edenbridge, Kent, but not early enough to appear in Webster's list of Greenwich Park birds for 1896–1901. By the 1940s it had reached the Park and I knew of a pair which nested annually from at least 1947–52. Nest sites included a hole in an elm in the Paddock in 1947 and 1948 and one in an old sweet chestnut in the Wilderness in 1949 and 1952. In 1953 and 1954 they were present, but there was no evidence of breeding. No more were reported until 1974, when the species was simply listed as observed, and 1975, when it was resident throughout the year (*BLRP* 1974, 1975). The next published record was not until 26 October 1997 when one was mobbed by blackbirds and other species in a tree between the Henry Moore statue and The Avenue (Brown 1998). For Blackheath, the only record is one seen on 16 March 1954 which eventually flew into Greenwich Park (Teagle 1997).

Tawny owl *Strix aluco*: this was considered a denizen of the Blackheath district in the mid nineteenth century (GNHC), but, surprisingly, was recorded only once in Greenwich Park during 1896–1901 (Webster). It was, however, reported in the Park from 1928–31 and in 1935 one could nearly always be seen in an oak in the bird sanctuary, but there was no evidence of a pair (Barclay-Smith).

I first heard a tawny owl in Greenwich Park when I happened to pass by at 04.30 GMT on 26 November 1943. From 1944–9 a pair probably nested, or at least attempted to do so, annually in the same oak in the Middle Bird Sanctuary, although the only evidence of this for 1948 was the discovery there on 12 February 1949 of the skeleton of a well-developed juvenile, thought to have lain there for less than eight months. A pair certainly used this site in 1949.

On 27 July 1950, T.C. Barbour, then Park Superintendent, showed me a hole at the top an elm in Bower Avenue where he said a pair had nested that year. What was presumably the same pair was believed to have nested there again in 1951, 1952, 1955 and 1957, and possibly in 1953, 1954 and 1956. In May 1955 an owlet was found under this tree and on 20 July and 4 August that year a juvenile was seen in one of the bird sanctuaries. Around 14 May 1957 an owlet was picked up and later hand-reared by one of the Park staff. In February 1954, a roosting site was discovered in an elm near the bottom of Royal Observatory Hill and was in continual use until at least spring 1958. In spring 1957 a tawny owl from it attacked a keeper, knocking off his hat.

On 6 February 1949 I discovered a tawny owl's regular roost in a sweet chestnut in the Middle Sanctuary. During that month, Owen and I collected a large quantity of pellets beneath it containing a high proportion of earth and roots, plus the hard parts of minotaur beetles *Typhaeus typhoeus*, a dung beetle that usually provisions its burrows with rabbit dung, but as rabbits died out years before in Greenwich Park it uses fallow deer dung instead. The earth and roots in the pellets strongly suggested that the owl dug the hibernating adult beetles from their burrows (Burton 1950, Owen and Burton 1950). This conclusion was supported by the number of minotaur burrows we found that had been dug up. Minotaur beetle remains were often very numerous in the pellets: for instance, in four collected on 12 February we identified the remains of 22 (13 males and 9 females) and another species of dung beetle *Geotrupes* sp., and 28 (12 males and 16 females) in another four pellets found on 19 February 1949. This crepuscular beetle does not usually become active until warm weather occurs in spring. I found pellets containing minotaur beetle hard parts in other years: e.g. on 3 and 26 March 1951 and 5 April 1952. Other prey remains identified by Owen and myself in pellets collected in the Park were field vole, wood mouse, greenfinch, house sparrow and starling.

In 1965 and 1966, tawny owls were probably resident in the Park with a pair in the Middle Sanctuary in both years, plus a bird heard calling on several dates in the One Tree Hill area in 1965, but there was no evidence of breeding (Grant). In 1967 two fledged owlets were seen in August (Montier 1968) and breeding was recorded in 1975 (*BLRP* 1975).

As already mentioned, the GNHC regarded the tawny owl as an inhabitant of the Blackheath area in the mid nineteenth century. Witherby occasionally saw or heard it there in 1894/5 and Rendall included it as a breeding species in his list of birds seen from 1912–37 in the vicinity of his home at No. 5 The Paragon, near Morden College, in the south-eastern corner of Blackheath. Although I was unable to provide definite proof, I suspected at least one pair of tawny owls of breeding in the vicinity of Morden College in the 1940s. I have notes of one calling in the grounds of the College in 1946 and 1947. On the south-west edge of the Heath, Owen heard two birds calling from garden trees in Heath Lane in May 1947. In the 1950s, Teagle (1997) also found tawny owls to be resident on the south-east edge of the Heath, but was likewise unable to obtain proof of breeding. He, too, often heard them calling from Morden College grounds and in the vicinity of his home at No. 2 The Paragon near by. In 1967 a pair was reported to be present at Blackheath in the breeding season (Montier 1968).

There were no more reports until one was seen at dusk in the garden of the staff cottage by Vanbrugh Gate on 11 February 1998 and heard calling later that month and in April. On 18 August 1998 a juvenile flew in daylight across Hyde Vale to the Park. In 1999 an adult was seen in May near Queen Elizabeth's Oak where, in June, an adult and up to three owlets were observed (Brown 2000).

Long-eared owl *Asio otus*: one was found roosting in Greenwich Park on 12 February 1976 (*LBR* 41: 44).

Nightjar *Caprimulgus europaeus*: Witherby reported that the nightjar 'once came to us annually'. Also listed as an occasional visitor to Greenwich Park during 1896–1901 (Webster). On 5 May 1958, one was flushed at dusk on Blackheath (Teagle 1997).

Swift *Apus apus*: this was considered an occasional visitor to Greenwich Park around 1900 (Webster) and was listed by Witherby and Rendall as occurring at Blackheath. In the 1940s and 1950s it was a frequent visitor from May–July over Greenwich Park from its breeding sites in the roofs of the older houses in the surrounding area. Sometimes feeding birds appeared over the Park just before dusk, as on 10 June 1949 when a large number hunted the numerous flies abroad on a dull, humid evening. Two days later I watched many flying low over the Park lake. In similar weather many low-flying birds were sometimes seen feeding over the Blackheath ponds; for instance, around 7.15 p.m. on 31 May 1948 I estimated at least 50 over the Prince of Wales Pond during 'one of the few bright periods in an otherwise cloudy, showery day'. On 2 July 1959, I met with a great many flying low over the Heath, close to Greenwich Park, pursuing cockchafers *Melolontha melolontha* which were extremely numerous that evening. On 27 July 1957 about 40 followed a motor mower on Blackheath, near St German's Place (Teagle 1997). In 1999, single swifts were seen as late as the 26 and 27 September (LNHS *Orn. Bull.* 246).

In 1965 and 1966 peak counts of swifts in July in Greenwich Park were of 66 and 53 respectively. In 1965 a marked passage of them flying west along the Park escarpment from 5–25 May was detected: a total of 163, with a peak on 8 May (Grant). The breeding colonies of swifts at Blackheath were then the nearest to central London (Gooders 1968). Nowadays they may be seen over Blackheath and Greenwich Park from May to August, but numbers are small except on the southbound passage when large numbers feed at dusk over the escarpment east of the Park (Brown pers. comm.).

Kingfisher *Alcedo atthis*: Both the GNHC and Webster recorded kingfishers as visitors to the lake in Greenwich Park and Witherby twice saw one in hard frosts at a little stream at Blackheath Park. A correspondent to the *Blackheath Local Guide and District Advertiser* of 4 December 1937 reported seeing one of these 'rarer visitors' at Blackheath. Hyatt saw one by his garden pond, close to the open Heath, at 07.20 hours on 15 September 1952 (Teagle 1998).

Hoopoe *Upupa epops*: occurred in Greenwich Park about 1850 (GNHC).

Wryneck *Jynx torquilla*: reported from Greenwich Park in the mid nineteenth century and around 1900 (GNHC, Webster). No other reports until 29 August 1976 when one, a passage migrant, was seen in a garden at Blackheath Park (*LBR* 41: 47).

Green woodpecker *Picus viridis*: listed by the GNHC and Witherby as an inhabitant of the Blackheath area, by Webster as breeding in Greenwich Park, and by Rendall as occurring in the vicinity of The Paragon, Blackheath. From 1943 I saw this species regularly in Greenwich Park and believed that a pair bred annually in the Wilderness from 1944–6. In 1947 I did not see any birds later than 13 April and I doubted that they bred in 1948, although at least one bird was seen quite frequently from late March–late August. Breeding was not suspected again until 1951. Previous failure to breed might have been due to nest-site competition from the increasing numbers of great spotted woodpeckers and starlings (Holroyde and Burton 1949). I obtained direct evidence of this some years later, on 16 March 1952, when I watched a green woodpecker at an old nest hole in an oak in the Wilderness being attacked and eventually driven off by three great spotted woodpeckers. That year, however, a pair bred successfully in an oak in the Wilderness and raised four or five young, and a pair also bred in 1953. In 1954 a nesting pair in the Wilderness shared a tree with a pair of starlings and a pair of stock doves, but were eventually evicted by a second pair of starlings (Brown and Phillips 1955).

Nevertheless, they apparently succeeded elsewhere in the Park, as a bird believed to have been a juvenile was seen on 31 August. Single birds were then occasionally heard or seen in or near Greenwich Park up to the winter of 1962/3, but breeding appears to have ceased.

Apart from one in September 1967 (Grant 1970), there were no reports of green woodpeckers in Greenwich Park after 1963 until mid March 1996 when one was seen. On 23 March that year two were present in the Flower Gardens and in April calling was heard in the Wilderness's deer enclosure and from around the reservoir. At least one pair appears to have bred successfully because on 7 August a juvenile was seen in the Flower Gardens/Wilderness area and two juveniles near the reservoir on 15 August. In 1997 persistent calling was heard in spring in the Wilderness area and occasionally in the vicinity of the reservoir and from 20 July juveniles were seen in both areas. At least one pair bred in 1998 in or near the Park. In 1999 a nest was watched in the deer enclosure and there was another in or near the west of the Park. Juveniles were seen in both years (Brown 1998, 1999, 2000).

I know of no green woodpecker breeding records for Blackheath, although Teagle and I sometimes heard and occasionally saw them during 1951–7. They returned to the Blackheath area about the time they reappeared in Greenwich Park.

Great spotted woodpecker *Dendrocopos major*: although mentioned by the GNHC as an inhabitant of Greenwich Park in the mid nineteenth century, it was not listed by Webster nor for Blackheath by Rendall. However, correspondents to the *Blackheath Local Guide and District Advertiser* issues of 20 November and 4 December 1937 mentioned its occurrence at Blackheath that year; one of them saw a male in a garden in Hervey Road on three occasions between 30 October and 8 November. The species had been increasing in north-west Kent and from the 1920s gradually spread into suburban districts (Homes et al. 1957).

By 1943 this species was established in both Blackheath and Greenwich Park and at least one pair bred annually, or attempted to breed, in the Park from at least that year to 1960 (three pairs in 1952), and perhaps beyond that as Grant reported a pair there in both 1965 and 1966. In 1965 a completed nest-hole in a tree in the Flower Gardens was usurped by house sparrows; nevertheless, juveniles were seen in August in both years.

Following a gap of several years in the records, probable breeding was reported in 1973 (*BLRP* 1973). In 1996, after another long gap in the records, the number of juveniles sighted in the Park suggested that two pairs had bred. In 1997, two young which fledged from a nest hole in the Wilderness area in May, an adult male with a recently fledged juvenile in the Observatory Garden on 8 July and another family party in the second half of July in the Wilderness implied three nests were successful. Earlier that year a nest hole on the western side of the Park was yielded to besieging starlings. A pair which used the same nest hole in a cedar *Cedrus* sp. in both 1998 and 1999 raised young both years and at least one other pair bred successfully in the Park (Brown 1998, 1999, 2000).

At Blackheath in the 1940s I encountered up to two great spotted woodpeckers at a time in the trees beside Morden College and in 1946–8 saw a male drumming there in spring. Teagle (1997) also recorded them in the south-eastern part of Blackheath on twelve dates between June 1953 and May 1959.

Lesser spotted woodpecker *D. minor*: listed as present but non-breeding in Greenwich Park (Webster) and Blackheath (Rendall). However, Witherby was informed by a Dr Fisher that it breeds in the Park. From 1943 a pair was usually present on my visits to Greenwich Park and I assumed that they nested there annually up to and including 1948. In 1948, both species of spotted woodpecker were often seen and heard drumming in the trees around the Park lake, a dead branch at the top of a sweet chestnut being used by both species (Holroyde and Burton 1949). Later there were few reports, usually of single birds, mostly outside the breeding season: in June 1951; February 1952; September 1956; a pair on 31 March and 19 April 1957; a male on five dates in 1958 which twice was heard drumming; in 1959; in February and August 1960; in August 1961; and in September and October 1962. Following a seven-year absence of records, one was seen in October 1969. The only reports in the 1960s and 1970s were the one in October 1969 and in 1974, when it was reported to be an occasional visitor, and in 1975 when it had become resident (*BLRP* 1974, 1975).

The next reported sighting of the lesser spotted woodpecker in Greenwich Park was of one in 1996, followed by seven in 1997, five in 1998 and eight in 1999. Most were seen either around the reservoir in the west of the Park or in the south-east quarter. In

1998 a male and female seen in January and February in the Woodland Walk at the edgeof the Wilderness could perhaps be linked to a male seen feeding a fledgling in a garden in nearby Vanbrugh Fields during the summer. The consensus is that the Park is involved in two territories (Brown 1998, 1999, 2000).

At Blackheath I watched, on 2 January 1948, a pair of these woodpeckers in courtship display in Morden College's grounds. In 1953 Teagle (1997) saw a pair mating in a tree by The Paragon on 16 May and he and I saw a juvenile in a *Robinia* in its grounds on 3 August. He also heard one calling to the south of this crescent on 1 September that year and in 1957 heard one calling near The Paragon on 7 January and 2 June (Teagle 1997). I am told that singletons or a pair have been seen in this area in most years since at least 1978 (Brown pers. comm.).

Woodlark *Lullula arborea*: one flying low over Blackheath on 19 October 1964 (Grant), two seen in Greenwich Park on 28 October 1969 (*LBR* 43: 47), and one heard calling over Blackheath and Greenwich Park with other migrants on 6 November 1998 (Brown 1999) are apparently the only records.

Skylark *Alauda arvensis*: considered by Webster at the beginning of the twentieth century to have been a regular visitor to Greenwich Park. At that time some pairs probably nested in the wilder grassy areas on Blackheath and certainly did so in fields at Blackheath Park and Kidbrooke (Witherby), though it was not on the list of Blackheath birds seen between 1912 and 1937 by Rendall.

When, in 1943, I first looked for birds on Blackheath, skylarks were numerous in the extensive areas of grassland enclosed by the military, and which were therefore largely untrampled, and in the coarse vegetation which had colonized those gravel-pits infilled with rubble from bombed buildings. Up to and including 1949 I estimated that as many as 25 pairs were on the Heath in the breeding season. On 8 July 1951 I estimated about 15 pairs as still there though the military had long since departed and the previously neglected sites were gradually being restored and 'improved'. I found nests in 1946 (two, both with clutches of three eggs), 1947 (one clutch of four eggs) and 1951 (a pair feeding nestlings). As late as 1952 I considered that there were five probable breeding pairs on the triangle of rough ground between the section of Prince Charles Road north of the A2 roundabout and the southern section of Maze Hill. There were probably a few other pairs attempting to breed on the remaining pieces of 'unimproved' land, such as around Whitefield's Mount. By 1953 only a few pairs probably managed to breed on the Heath 'in spite of the ploughing and sowing that went on' that year (Teagle 1997). On 3 August 1953 I watched five adults and two juveniles feeding on a still enclosed, ploughed expanse to the east of Talbot Place.

At least three pairs of skylarks were still present on Blackheath in April 1954 and a few males continued song-flights there until 1957, despite the complete restoration of public access rendering the grassland unsuitable for breeding (Teagle 1997). Since then only a few wintering birds have been seen, although they may sometimes be observed flying over on passage, occasionally in considerable numbers, such as the more than 200 seen by Teagle to fly north-west over Blackheath and Greenwich Park during the morning of 19 October 1958. On exactly the same date in 1964, 288 flew west in an hour over the Park (Grant). A recent autumn passage on 9 November 1998 amounted to 35 birds (LNHS *Orn. Bull.* 241).

Outside the breeding season, especially in winter, many small flocks, and occasionally some quite large, fed on Blackheath in the 1940s, often with house sparrows and linnets. Winter numbers dwindled in the 1950s. Up to four birds on the Heath from 14 January to 17 March 1966 were considered a hard–weather arrival (Grant).

Sand martin *Riparia riparia*: reported by the GNHC from Blackheath in the mid nineteenth century when it probably nested in one or more of the gravel-pits. It may have continued to do so, unnoticed, up to the Second World War, as in 1943 I discovered a few pairs nesting in the steep face of the deep, southernmost of the Vanbrugh Pits where a barrage balloon was moored. They returned in 1944, but soon afterwards the pit was infilled with wartime rubble, destroying the site.

Subsequently, I saw sand martins at Blackheath only on 31 May 1946, when several were skimming over Whitefield's Pond. Teagle, however, watched two flying low over the Heath on 26 August 1958 and at dawn on 1 April 1966 Grant saw one flying very low and fast northwards.

In Greenwich Park, the sand martin was an occasional passage migrant, as it was in Webster's day. Teagle (pers. comm.) saw two flying north-west over the Roman 'villa' site on 31 March 1958, one flying south-west over the north-east corner of the Park on 12 October 1958 and another flying east over the tennis courts on 29 August 1961.

Finally, on one of my rare visits since 1959, I saw about 30 circling and skimming over the lake on 4 September 1975.

Swallow *Hirundo rustica*: described by the GNHC in the mid nineteenth century as 'abundant formerly' in the Blackheath district. It was still breeding during 1896–1901 in the old barn and deersheds of Greenwich Park (Webster) and continued to do so until 1928. It was common in the breeding season in the 1890s in the Blackheath district (Witherby) and may have continued so into the 1930s as Rendall included it as a breeding species in his 1912–37 list.

Since then, swallows have been seen only on migration. In the late 1940s and early 1950s, Hyatt, Owen and I usually observed them in ones and twos in spring, and occasionally in autumn in larger numbers, such as on 21 September 1952 when Hyatt and I saw parties of swallows and house martins flying west over Blackheath and Greenwich Park all morning. There was a similar large movement with house martins on 18 September 1954 (Teagle 1997). Teagle (pers. comm.) noted a few, mostly singletons, on passage over Greenwich Park in spring and autumn 1958 and on 10 May 1959. Our earliest arrival date in spring was 9 April 1947. The migration pattern in Greenwich Park in 1965 and 1966 was very similar (Grant). Today, the picture continues to be of a few in spring and autumn with occasional large autumn movements (Brown pers. comm.). In late September 1999 Blackheath received its share of a huge westerly movement through the London area: over 200 on the 25th, 850 on the 26th, peaking up to 1,000 in two hours on the 27th (LNHS *Orn. Bull.* **246**).

House martin *Delichon urbica*: recorded from the Blackheath district in the nineteenth century by the GNHC and Witherby, presumably breeding as it still did in 1912–37 (Rendall). When I came to the area in 1943, small colonies of house martins were nesting in and around Blackheath Village and the outskirts of the Heath and Greenwich Park. Recently, Teagle (1997) described the small breeding colonies at Blackheath between 1953 and 1958, mostly in and around the Village. In 1954 the breeding population was 18 pairs but subsequently declined to about nine. In 1965 and 1966 up to 20 frequented the Blackheath ponds (Grant), thus suggesting a slight increase in line with the general recovery of the breeding population in London since the introduction of the smokeless zone in 1952. Numbers, however, have lately fallen back: few pairs can now be found (Brown pers. comm.).

In the 1940s, Owen and I regularly saw house martins in numbers varying from singletons to many on passage in late April and May, usually flying over the ponds. In August (e.g. 19 August 1948) we sometimes observed large flocks gathering on the Heath. In September we often noticed them flying west over the Heath and Greenwich Park; for example on 21 September 1952, when many flew with swallows (q.v.).In the 1950s and 1960s the second week of September seemed the peak period for passage (Grant 1967, Teagle 1997). Nowadays, passage is normally light (Brown pers. comm.), but especially large numbers passed west over Blackheath in September 1999: 250 on both the 26th and the 27th (LNHS *Orn. Bull.* **246**).

Tree pipit *Anthus trivialis*: recorded by the GNHC from Blackheath in the mid nineteenth century when some areas were probably still suitable enough for it to breed, and as an occasional visitor in the 1890s by Witherby. A regular visitor to Greenwich Park in 1896–1901 (Webster), but not included by Rendall in his 1912–37 Blackheath list. I never encountered them in the area in the 1940s and 1950s, but Teagle watched two feeding close together amongst trees in the south-west corner of Greenwich Park on 29 August 1961. Next year he saw one on 7 May. Also in Greenwich Park, Grant observed tree pipits on spring and autumn passage in 1965 and 1966, usually flying over, though he did occasionally see one or two birds at a time feeding on the ground near Wolfe's statue or in the Flower Gardens. On 9 May 1999, a passage bird flew over the Park (LNHS *Orn. Bull.* 244).

Meadow pipit *A. pratensis*: a few pairs may have bred on Blackheath in the early part of the nineteenth century when suitable habitat still existed and where it was recorded by the GNHC and also by Witherby in the 1890s. Although Webster made no mention of this species, in the 1940s and 1950s my friends and I occasionally saw one or more flying over Greenwich Park outside the breeding season. On 1 October 1947, a fine and warm day, several small parties, presumably passage migrants, were flying in various parts of the Park. Intensive observation shows that small numbers continue to be seen in or flying over Greenwich Park in spring and autumn (Grant 1967, Brown 2000). In the 1940s Owen and I regularly saw parties of three to seven birds on Blackheath as well, feeding in rough grassy areas between October and early April. Once, on

3 December 1946, I noted that meadow pipits were 'plentiful' on the Heath. In the 1950s Teagle found them regular on spring and autumn passage there; he sometimes saw them in winter as well. The big migration weekend of 25–26 September 1999 included more than 200 over Blackheath and Greenwich Park (LNHS *Orn. Bull.* **246**).

Yellow wagtail *Motacilla flava*: recorded at Blackheath in the mid nineteenth century (GNHC) and as a visitor there 1912–37 (Rendall); also in Greenwich Park 1896–1901 (Webster). In the 1940s up to five pairs nested or tried to do so on Blackheath among the weeds and coarse grasses that flourished during and just after the war (Burton 1972). A nest I discovered with three eggs on the Circus Field on 3 June 1944 was deserted due to military activity near by. The post-war reclamation of these rough areas eventually led to the end of breeding on Blackheath. My last record of a pair breeding successfully was in 1951 when four or five young were raised on rough grassland surviving at the site of the former army Nissen huts. One of the parents frequently collected beakfuls of insects from a dung heap in Greenwich Park's Wilderness where we occasionally saw lone yellow wagtails during the 1940s and 1950s. In May 1952 a male sang from the top of a large rusty can lying in rough ground between the northern section of Prince Charles Road and the southern end of Maze Hill, but it failed to attract a mate. One of its droppings I examined contained beetle remains, mostly weevils of the genus *Phyllobius*.

Subsequent records include: one on the Ranger's Field, Greenwich Park, on 25 April 1958 and the odd bird on Blackheath in the late 1950s (Teagle 1997); in Greenwich Park on 15 April and 8 May 1962, and passage birds flying over it on several dates in the autumns of 1965 and 1966, and one on Blackheath on 29 April 1965 (Teagle et al. 1964, Grant 1967). During a visit to Blackheath on 30 August 1983, Owen and I saw one fly calling southwards over Whitefield's Mount. On 22 August 1999 three flew south-westwards over Greenwich Park (Brown 2000).

Grey wagtail *M. cinerea*: not reported in the area until listed as a visitor to Greenwich Park in 1896–1901 (Webster) nor subsequently until the mid 1940s when I saw grey wagtails in the Park throughout the year. A pair bred successfully in 1944 and 1945, possibly in 1946 and for certain in 1947 when five young fledged in July. After that, they appeared only as occasional visitors, usually on autumn passage, as they continue to do so nowadays. In 1996–8 one or two were seen each year (Brown 1998, 1999). On Blackheath records are few: Hyatt saw three together fly over on 28 January 1948, one was by the Prince of Wales Pond on 8 October 1956 (Teagle 1997) and one of those seen in Greenwich Park in 1996 paused next at the same pond.

Pied wagtail *M. alba*: first reported from Blackheath in the nineteenth century (GNHC) and as a breeding species during the 1890s (Witherby) and from 1912–37 (Rendall) as well as in Greenwich Park in 1896–1901 (Webster). It was still fairly common in 1943 and I considered it a regular breeder in suitable sites both at Blackheath and in Greenwich Park. Usually one pair frequented Greenwich Park in the breeding season, though in 1953 and 1958 there were at least two pairs (Teagle and Teagle 1959). One pair in 1958 reared two broods near the Ranger's House. In 1954 and 1955 pairs nested just outside the Park at Blackheath, but were seen to collect food inside it, later being joined by their offspring (Brown and Phillips 1955, Phillips and Manser 1957). As Table 1 shows, few frequented Greenwich Park in winter in the 1950s. Teagle (1997) has given a full account of pied wagtails on Blackheath in the 1950s and 1960s, as has Grant for 1965 and 1966, when at least one pair nested there successfully in both years.

Nowadays, the pattern seems to be few, if any, pied wagtails in Greenwich Park in November–February (the Heath and the Thames banks appear to be preferred), a passage in mid March, a few breeding birds visiting, post-breeding family gatherings in August (e.g. 31 on 26 August 1999) and then a gap until an autumn movement in October (e.g. 44 on 9 October 1997) (Brown 1998, 2000).

Waxwing *Bombycilla garrulus*: the only records of which I am aware are: one picked up dead at Kidbrooke, adjacent to Blackheath, in March 1947 and given to Owen; a flock of 19 at Blackheath and four in Greenwich Park on 27 January 1996; and seven in the Park on 6 February and five on 12 February 1996 (*LBR* **61**: 121).

Wren *Troglodytes troglodytes*: recorded by the GNHC as an inhabitant of the Blackheath district, as a breeding bird in Greenwich Park in 1896–1901 (Webster), and at Blackheath in the 1890s (Witherby) and from 1912–37 (Rendall), it was still a plentiful breeding species throughout the area in the 1940s and 1950s. In Greenwich Park up to four pairs at least nested every year during 1944–66 and it is still quite a common breeding resident wherever there are shrubs and bushes in the Park. Table 1 shows that up to four wrens were usually present in Greenwich Park in the winter months of 1958 and 1959.

Dunnock *Prunella modularis*: described by Grinling as 'generally distributed and common everywhere' in the north-west Kent area, including Blackheath, where Witherby fround 'a good many' nests in 1894, and Greenwich Park where Webster recorded it as breeding in 1896–1901. This was still its status between 1912 and 1937 (Rendall) and it continues to be a common breeding resident in Greenwich Park and the Blackheath area (Brown 2000). A series of winter counts in 1958 and 1959 showed that the population then varied between two and 14 birds (Table 1). The breeding population in the Park was 18 pairs in 1965 and 25 pairs in 1966 (Grant).

Robin *Erithacus rubecula*: recorded as breeding in Greenwich Park during 1896–1901 (Webster) and at Blackheath in 1895 (Witherby) and from 1912–37 (Rendall). It continues to breed plentifully in suitable locations, such as Greenwich Park and in large gardens in the district. An indication of the breeding population in the Park was given by Grant who located 16 pairs there in 1965 and 18 in 1966. Winter counts made in 1958 and 1959 (Table 1) showed that the population varied from five to 18 birds.

Nightingale *Luscinia megarhynchos*: reported by the GNHC as an inhabitant of Blackheath and Kidbrooke in the mid nineteenth century where Witherby saw and heard it 'many times' in summer, it was seen only once in Greenwich Park by Webster during 1896–1901. Since then the only other published records are of two seen in one of the sanctuaries in the Park on 7 May 1963 and a male reported singing there later in May (Tinning et al. 1966).

Black redstart *Phoenicurus ochruros*: from 23 March to 6 April 1946 I saw a female at the Nursery end of the Wilderness in Greenwich Park, apparently the only one seen there so far, though it breeds not far away beside the Thames.

Redstart *P. phoenicurus*: this summer visitor used to be 'fairly common' in Greenwich Park (GNHC) and was recorded as a regular visitor to the Park in 1896–1901 (Webster). Witherby said it nested there. It was not, however, on a 1912–37 list of Blackheath birds (Rendall) and I was never fortunate enough to see it in the area in the 1940s and 1950s, though Teagle saw both a male and a female close to his home in The Paragon, Blackheath, on 13 April 1953; one in Greenwich Park on 8 September 1956 (another had been seen three days previously) and a female in the trees beside the Ranger's Field in Greenwich Park on 17 August 1958. A few birds were seen on passage in the 1960s when regular observations were made (Teagle et al. 1964, Grant 1967). Since then a female was seen in the Flower Gardens on 27 September 1998 (Brown 1999).

Whinchat *Saxicola rubetra*: an apparently regular passage migrant through Greenwich Park during 1896–1901 (Webster). Since then records for the Park are one seen on 7 May 1962 (Teagle et al. 1964) and some seen on spring passage in 1963 (Tinning et al. 1966), and another on 7 August 1997 (*LBR* **62**: 134). At Blackheath one was watched on the lawn of The Paragon on 28 September 1957 (Teagle 1997) and I am told that there have been autumn sightings at Whitefield's Mount recently (Brown pers. comm.).

Stonechat *S. torquata*: described by the GNHC as formerly generally distributed in the Blackheath area, presumably at a time when gorse *Ulex* grew more extensively on the Heath than now. Webster recorded it as an occasional visitor to Greenwich Park in 1896–1901 but it has not, apparently, been recorded since.

Wheatear *Oenanthe oenanthe*: reported from Blackheath in the mid nineteenth century by the GNHC, as a 'fairly regular' visitor by Witherby in 1895, and at times from 1912–37 by Rendall. From 1943 I found it to be a regular passage migrant in spring and autumn on the Heath. While the surface of the gravel-pits, which had been infilled with wartime debris from bombed areas, was very rough and uneven with low piles of bricks and projecting masonry, it proved attractive to wheatears. During the 1940s and 1950s they were regularly to be seen on passage (6 was the maximum recorded per day in spring and 10 in the autumn); they even nested in 1946. The recorded duration for the spring passage on Blackheath was from 23 March to 12 May and for autumn passage from 13 August to 13 September.

In the late 1940s, some birds, especially towards the end of April and in May, looked too large to be common wheatears and were thought by Hyatt, Owen and myself to be of the Greenland race *O. o. leucorrhoa*. For example, I described a female on 5 September 1947 as 'looking almost the size of a Song Thrush'. A large male I found dead in Greenwich Park was, however, considered on examination at The Natural History Museum, South Kensington, to be merely a large and rather bright common wheatear, but I still have my doubts!

On 30 April 1946 I discovered two nests of wheatears under piles of bricks and similar debris on Blackheath: one contained two eggs, the other three. In both instances the females appeared to be incubating. When visited on 9 May the nest with three eggs and its immediate surroundings had been completely destroyed, but the two eggs in the other nest had hatched. Later in the month I watched the adults feeding two nestlings as they sat at the nest entrance. Both fledged successfully. The actual site of the successful nest was close to the old anti-aircraft gun emplacements at the eastern edge of the Circus Field; the unsuccessful nest was situated on the eastern side of what was, before it was infilled, the Old Donkey Pit, near Folly Pond. In the light of these old breeding records, it is of interest that Grant saw two juveniles in Greenwich Park on 25 August 1965 and another juvenile on Blackheath on 16 August 1966. Although hardly any suitable habitat remained on Blackheath by the 1960s, it is possible that they were reared not very far away, perhaps on industrial wasteland beside the Thames.

Teagle (1997) recorded wheatears on Blackheath every year from 1953–8 and Grant noted them on 23 March 1965 and 16 August 1966. Brown (pers. comm.) saw at least four there on the foggy morning of 27 August 1990 and considers it not unusual to see one or two on the open Heath on passage.

In Greenwich Park there is less open ground; nevertheless, there are some records of wheatears. One was seen in late August 1954 (Brown and Phillips 1955) and another on the Ranger's Field on 12 August 1956 (Teagle pers. comm.). In 1961–2 they were recorded on passage in both years, including a total of five on 7 May 1962. In 1965 one was seen as early as 10 March and in 1966 a male was seen on 25 April (Grant). Recently, a 'southbound juvenile' was seen on 27 August 1997; a male and a female were seen on 28 March and another female on 9 May 1998; and two males were in the deer enclosure on 23 April 1999 (Brown 1998, 1999, 2000).

Ring ouzel *Turdus torquatus*: reported from Blackheath in the mid nineteenth century (GNHC), where Witherby remarked that it 'used to visit The Paragon'. Since then records are two in the Flower Gardens in Greenwich Park on 5 April 1966, a male in the Park on 20–21 April 1966 and another male on open ground below the Wolfe statue on 10 May 1966 (Grant), and a male present at Blackheath from 25 September to 1 October 1974 (*LBR* **39**: 49). The most recent record is of at least three females in Greenwich Park on 30 April 1999 (Brown 2000).

Blackbird *T. merula*: around the beginning of the twentieth century the blackbird was reported to be generally common in the south-east London area, including Blackheath and Greenwich Park (Witherby, Grinling et al., Webster). It was on a list of garden breeding birds for the period 1912–37 (Rendall) and Barclay-Smith (1929–39) reported that it nested in 'good numbers' in Greenwich Park. This was still the situation in the 1940s and continues to be so.

In 1958, 1959 and 1960, Teagle counted blackbirds in Greenwich Park (Table 1), especially in 1958 when totals varied from 33 (22 of them males) on 14 February to 62 on 31 March, and from 102 on 22 November to 52 on 21 December. The fewer complete censuses made in 1959 gave totals varying from 99 on 3 January to 54 on 11 January. The complete census Teagle undertook on 31 March 1958, totalling 62 birds, suggested the likely number of breeding pairs in the Park that year to be *c.*30. Breeding censuses by Grant produced 54 pairs in 1965 and 49 pairs in 1966.

Clutch sizes in Greenwich Park in the 1940s and 1950s, based on the records of Owen, Teagle and myself, varied from one to five eggs, the average being 3.5. Schoolboys destroyed some nests. Where eggs and young disappeared without the nests being destroyed or damaged jays and grey squirrels were thought to be the chief culprits. For instance, on 5 June 1949 Owen disturbed a squirrel which was in the process of investigating a blackbird's nest in the Park containing four eggs.

Fieldfare *T. pilaris*: the first reference to the fieldfare in the area is Witherby's remark that it frequents the fields and hedges in the Manor Way and at Kidbrooke. It is also in the list of species visiting Greenwich Park in 1896–1901 by Webster. My first record for the area was a small flock in Greenwich Park on 11 November 1943; my next was for 24 February 1946 when I noted them as 'plentiful' in the Park. In the severe winter of 1946/7 I frequently saw them in the Park and on Blackheath. For instance, I noted 'many' on the Heath on 13 November 1946 and about 30 feeding in a group of hawthorns in the Park on 7 February 1947. In the next winter, 1947/8, my maximum was only six in Greenwich Park's Wilderness, and Owen watched a party of eight flying south over Blackheath on 22

February 1948 when deep snow lay on the ground. My only record in the winter of 1949–50 was a flock of about 60 which flew south-west over Blackheath on 13 November 1949, then changed direction and flew into Greenwich Park.

The pattern was much the same in the 1950s and early 1960s (Teagle unpub. notes; 1997). It was not until Grant made his intensive migration watches in Greenwich Park from 1964–6 that it was shown how frequently, when looked out for, fieldfares could be seen flying over between the beginning of October and the end of April, especially in October, November and March. Sometimes, the numbers passing on migration were quite high, such as 164 seen flying west in 45 minutes on 25 October 1966. The numbers in spring were much lower, reaching a maximum of 27 flying west on 31 March 1966; they could also be seen flying high during cold-weather movements. For example, on 19 January 1966, some 34 flew east-south-east in 15 minutes (Grant).

More recently, ten fieldfares flew south-west over the Park on 23 January 1997 and two flew northwards from the Flower Gardens on 4 April. That autumn, flocks were seen moving through in October (Brown 1998). In 1998, however, as many as up to 600 in a day flew over Blackheath and the Park in the first week of November (LNHS *Orn. Bull.* **241**)! Unusual dates are the following: two in the Flower Gardens–Wilderness area on 1 May 1960 (Teagle pers. comm.) and one in the Wilderness in mid April 1996 (Brown 1998).

Song thrush *T. philomelos*: described as generally distributed and 'greatly exceeding the Blackbird in numbers in the more populated parts of the district' (Grinling et al.). Witherby reported that in 1894 there were about three song thrush nests for every one of the blackbird in the Blackheath area. It was listed as breeding in Greenwich Park from 1896–1901 (Webster), at Blackheath during 1912–37 (Rendall) and in Greenwich Park in the 1920s and 1930s (Barclay-Smith 1929–39).

The song thrush was still a common breeding species in 1943 and remained so throughout the 1950s and 1960s. Table 1 shows day counts of up to 19 in Greenwich Park in 1958 and up to 16 in 1959. Counts were between 8 and 22 in 1965 and 1966 (Grant). In late January 1960 a heavy influx of thrushes included 21 song thrushes (Teagle and Tinning 1962). Grant reported that 18–20 pairs bred in the Park in both years, although no juveniles were noted in the latter year. When I visited the Park on 28 July 1971 and 4 September 1975, the population seemed to be more or less unchanged. However, numbers had declined by the 1990s. A territory is held each year in the south-east corner and a few pairs nest near the Park (Brown 2000). Judging by the records of Teagle and myself, the usual clutch size in the Park was three eggs, but four were laid occasionally.

Redwing *T. iliacus*: although stated by Grinling to be generally distributed in winter in south-east London, the only specific reference to the Blackheath area was by Witherby who stated that it frequented the fields and hedges in the Manor Way and at Kidbrooke. The redwing was also listed as a visitor to Greenwich Park in 1896–1901 by Webster. I found it to be a regular winter visitor to both Blackheath and Greenwich Park in the 1940s and 1950s, especially in hard weather, as did Grant in the 1960s.

In the 1940s, large flocks of redwings were attracted to the wartime allotments at the northern end of Greenwich Park until the area was restored to grassland at the end of the decade. Flocks of considerable size continued to appear from time to time in cold weather, such as the flock of about 50 which came with a large influx of blackbirds and song thrushes on 23 January 1960. By 30 January some 65 redwings were in the Flower Gardens (Teagle and Tinning 1962). On 30 January 1961 a flock of 72 arrived in these gardens. Regular migration watches from 1964–6 revealed that considerable numbers flew over the area between early October and late December, the peak movements being 260 in one hour on 19 October 1964 and 72 in 30 minutes on 8 November 1966 (Grant). Nowadays, redwings are seen in the deer enclosure from about Christmas to mid March. Peak numbers vary with the weather (e.g. up to 50 in 1998). They are generally fairly common on playing fields and in gardens throughout the area (Brown 1999).

Teagle (1997) often heard redwings flying over Blackheath at night in October and November in the 1950s and sometimes saw small flocks flying over on winter days. Two recent records of winter movements over Blackheath are of 160 flying over in 15 minutes on 3 November 1994 (*LBR* **59**: 128) and 350 on 7 November 1998 (LNHS *Orn. Bull.* **241**).

Mistle thrush *T. viscivorus*: reported by Witherby to be apparently 'less numerous than a few years ago' in the Blackheath area, this species bred in Greenwich Park in 1896–1901 (Webster). Rendall included it on his Blackheath list covering 1912–37, but not as a breeder. In 1938 it was still among the breeding species in Greenwich Park (Barclay-Smith) and was still breeding there when I began my visits in 1943. There were five pairs in the Park in the 1965 breeding season and six in 1966 (Grant). Five to six pairs represents, in my opinion, the number of breeding pairs present most years in the 1940s and 1950s. Adults feeding young and fledged juveniles were often seen then. Up to five pairs still seems to be normal (Brown 2000). Other pairs probably nested during the 1940s and 1950s in large gardens at Blackheath as Owen and I often observed singing males in spring and juveniles on the Heath in summer. 'A few pairs' of these thrushes alighted on the Heath to feed in 1954 (*BLRP* 1953–54).

Outside the breeding season, gatherings of mistle thrushes in Greenwich Park in the 1940s and 1950s sometimes became quite large. For instance, on 18 November 1947 I watched about 20 feeding on rowan berries in the Flower Gardens with blackbirds and jays, and Teagle counted 11 feeding on rowan berries in the same place on 14 August 1960. Such gatherings still happen: a flock peaked at 29 on the Ranger's Field on 27 August 1997, followed by another build-up when a maximum of 34 was counted on 27 September (Brown 1998). A flock of 25–30 was seen on 15 September 1998 which declined to ten two days later (Brown 1999). Winter counts in 1958 and 1959 are presented in Table 1.

Grasshopper warbler *Locustella naevia*: in 1895, Witherby stated that this is now a scarce summer visitor and 'has been seen and heard in Blackheath'. I know of on other reports.

Sedge warbler *Acrocephalus schoenobaenus*: bred in the marginal vegetation of Greenwich Park's ornamental lake in 1896–1901 (Webster), but apparently ceased to do so not long afterwards. I never chanced upon sedge warblers in the Park in the 1940s and 1950s when the lake was in a bad state, though Teagle found one singing there on 11 May 1958. Another was singing by the lake on 7 May 1962 (Teagle et al. 1964). By 1965 the condition of the lake had been greatly improved and males were singing there on 3, 10 and 16 May 1965 and on 10 and 20 May 1966; also in 1966 a male sang in another part of the Park (Grant).

Reed warbler *A. scirpaceus*: recorded by Webster as breeding in 1896–1901 in the reeds then fringing the ornamental lake in Greenwich Park. The only subsequent records I know are: one closely watched by Teagle in the willows and irises on the east bank of the lake on 18 August 1961, singletons seen on four dates in early May 1963 (Tinning et al. 1966) and also by the lake on 10 May 1965 and 11 May 1966 (Grant).

[**Dartford warbler** *Sylvia undata*: first discovered in Britain in 1773 in the Dartford district, not many miles from formerly suitable habitat for it on Blackheath. It was reported by a Mr Rennie to have occurred on the Heath in 1830 (Grinling).]

Lesser whitethroat *S. curruca*: recorded in the Blackheath district (GNHC) and as breeding regularly at Greenwich (?Park) by Witherby, but not on other pre-war lists. I never encountered it in the 1940s and 1950s, presumably overlooking the occasional passage migrant, as Teagle found single males singing in Greenwich Park on 6 May 1956, 4 May 1957, and 11 May 1958. Then, on 29 June 1958, he discovered an apparent pair at the north side of the Park's Magnetic Observatory which appeared to have a nest in dense bushes inside the perimeter fence as the female was busily collecting insects and taking them there. The male expressed resentment when a closer inspection was attempted and neither bird was seen again after 2 July (Teagle and Teagle 1959).

Lesser whitethroats were seen in the Park on three dates in early May 1963. Then, in 1965, Grant located three singing males and proved breeding when, on 26 May, he discovered a nest with three eggs beneath the tall holly used by the male as a song-post. By the 28th there were five eggs, which hatched on 9 June. The next day the nest was empty and he suspected grey squirrels of responsibility. A second attempt was apparently made as on 15 July he saw what was presumably the same pair feeding a half-fledged juvenile and on 26 July a family party of five. In 1966 he saw only three individuals and no further attempt to breed was made. The only record for the Park since then of which I am aware is of two birds in the enclosed area below Flamsteed House early on 5 August 1997 (Brown 1998).

Whitethroat *S. communis*: recorded as probably breeding in the Blackheath district in the 1890s (Witherby) and as breeding in Greenwich Park during 1896–1901 by Webster, but not mentioned by subsequent pre-war authors. The first I heard and saw was a male in the largest bird sanctuary in Greenwich Park from 10–28 May 1948. In the summer of 1953 one sang in a wild area behind The Paragon and on 2 August a female fed three well-fledged young. In subsequent years passage at Blackheath was noted and song was heard on a bomb-site by Colonnade House in July 1955 and in June and July 1960, in the garden of The Paragon in July 1956 and in the grounds of Morden College in June 1960 (Teagle 1997). In Greenwich Park, a whitethroat seen in 1954 was stated to be the first recorded since 1949 (Brown and Phillips 1955). In 1955 one sang near the Propagator's House on 25 June (Phillips and Manser 1957). In 1957 Teagle located one in the Tumuli area on 19 April and another singing near the Reservoir on 4 May. In 1960 one singing in the Flower Gardens on 8 and 9 May was joined by another singing male on the latter date. On 13 August a male on passage was seen in the Rose Garden. One to three were recorded on passage in spring and autumn in 1965 and 1966 (Grant), and a juvenile was seen in the Rose Garden on 29 August 1999 (Brown 2000). On 30 August 1983, Owen and I saw a whitethroat in the deepest of the Vanbrugh Pits just outside the Park wall and one sang there in 1998 (Brown pers. comm.).

Garden warbler *S. borin*: recorded as probably breeding at Blackheath in the 1890s (several pairs) (Witherby) and as a visitor to Greenwich Park during 1896–1901 (Webster), it was later reported to be a non-breeding visitor to Blackheath (Rendall). At Blackheath in 1953 one was seen by The Paragon on 2 August; in Greenwich Park a male sang on 11 May 1958 and another on 17 August; one was seen on 16 May 1959 (Teagle 1997) and two there on 7 May 1962 (Teagle et al. 1964). A few passed through the Park in spring and autumn in 1965 and 1966 (Grant), and one was seen in the Flower Gardens on 21 May 1998 (Brown 1999).

Blackcap *S. atricapilla*: reported from the Blackheath area in the nineteenth century by the GNHC and by Witherby and as breeding in Greenwich Park during 1896–1901 by Webster. In 1947, Owen and I came across a male singing by the lake in the Park on 13 May. On 21 May 1948 F.J. Holroyde watched one singing there. In 1949 Owen and I found a male singing in the Park in June and suspected breeding in the Large Bird Sanctuary. The only year in which Teagle (1997) recorded blackcaps singing at Blackheath was in 1953 when he heard one in Morden Road Mews in May and another in The Paragon garden from May until early July. On 1 May 1954 a pair was present in Greenwich Park (erroneously stated by Brown and Phillips (1955) to be the first since 1948), but did not breed. On 11 May 1958 Teagle located a pair in the Park's Middle Bird Sanctuary and watched a male singing near it on 25 May. In 1959 he found a male singing near Chesterfield Lodge on 16 May and two singing in the Wilderness area on 24 May.

By the 1960s blackcaps had become more frequent. Grant saw them regularly in Greenwich Park and recorded a pair present in the 1965 breeding season in the Large Sanctuary, plus an apparently unmated male in the Middle Sanctuary. In 1966 two pairs occupied these sanctuaries and successful breeding was proved in one case (Grant). Nowadays, at least two pairs breed annually in the Park and more in nearby gardens. Some — more males than females — overwinter.

Wood warbler *Phylloscopus sibilatrix*: listed by Webster as a visitor to Greenwich Park in 1896–1901. The known records since then, all from the Park, are: a male singing from birches in the Large Sanctuary on 5 May 1948 (pers. obs.); a male feeding and singing in a Turkey oak *Quercus cerris* north of the Magnetic Observatory on 25 April 1957 and a male feeding and singing in a sycamore in a wooded part of Lovers' Walk, near One Tree Hill, on 4 May 1958 (Teagle pers. comm.); also one feeding in bushes below Wolfe's statue on 24 August 1965 and one near the ornamental lake on 19 August 1966 (Grant).

Chiffchaff *P. collybita*: recorded as occurring in the Blackheath district (GNHC, Witherby) and as a non-breeding visitor to Greenwich Park during 1896–1901 (Webster), this warbler continued to be a passage migrant in the area throughout 1912–37 (Rendall) and into the 1940s and 1950s, possibly staying to breed occasionally. Breeding was suspected, for instance, in 1948 when two males held territories in Greenwich Park's Large Sanctuary. Thereafter, although chiffchaffs were regular as passage migrants in spring and autumn, nesting was not again suspected until 1958, when a pair was located near the Magnetic Observatory in July, the female of which behaved in an anxious manner (Teagle and Teagle 1959). Intensive observations from 1964 to 1966 revealed the scale of the spring and autumn movements through Greenwich Park. Autumn passage peaks of 6 in a day in 1964 (30 September), 7 in 1965 (24 September) and 10 in 1966 (16 September) were recorded (Grant).

On 5 June 1974, during one of my rare visits to Greenwich Park since the 1950s, I heard a chiffchaff singing in Bower Avenue. Nowadays, they are still heard in spring and autumn. In 1998 one sang in a localized part of the Flower Gardens from 12 to 21 May and one was singing there again in May 1999 (Brown 1999, 2000).

At Blackheath I heard a chiffchaff singing in the wooded garden of Woodlands, Mycenae Road, on 5 May 1947 and Teagle (1997) noted singing birds annually from 1953 to 1958 inclusive, mainly in September. He also heard one by Colonnade House on 29 August 1961. In 1998, and again in 1999, one sang regularly in the railway cutting to the east of Blackheath Station (Brown 1999 and pers. comm.).

Willow warbler *P. trochilus*: reported to be common in the Blackheath district early in the nineteenth century (GNHC), but included only as a non-breeding visitor to Greenwich Park during 1896–1901 and at Blackheath during 1912–37 (Webster, Rendall). However, Witherby recorded a nest in a garden on Blackheath Hill in 1894. But Barclay-Smith considered that it probably bred annually in Greenwich Park around 1930 and that towards the end of the decade it was nesting in 'good numbers'. In 1936, she reported, a 'great many' passed through the Park in August and September. Teagle (unpub. MS 1959) commented that at this time the Park provided more suitable habitats than it did later. The shrub and herb strata in the sanctuary enclosures would have been more luxuriant than in the early 1950s, as there would have been less overshading. This was the case in the 1940s when I began visiting Greenwich Park, except that wartime neglect was already leading to the sanctuaries becoming too densely vegetated and overshaded.

Nevertheless, willlow warblers still visited Greenwich Park in good numbers in the 1940s, several at least remaining throughout the summer. A nest Owen and I discovered on 18 June 1946, containing five almost fledged young, was situated in long grass under a gorse bush in the Flower Gardens only a little over a metre from a path much used by the public. On 7 May 1947 I noted 'many' in the Park; but from 1948 onwards the numbers of summering birds declined (coincident with considerable housing development between Blackheath and the Kentish countryside beyond) and only two pairs were known to have nested that year (Holroyde and Burton 1949). Although several sang in the Park in May 1949, only one pair was known to have bred. Only one pair was known to have nested in 1950 and none from 1951–3, although at least one singing male was present. On 20 June 1954 a nest contained six tiny young in the Large Sanctuary of the Wilderness which were successfully reared (Brown and Phillips 1955) and there was a second pair in the Middle Sanctuary, but it is not known if they actually nested. The next breeding recorded was a nest containing two young in long grass and scrub at the edge of the Magnetic Observatory enclosure on 13 July 1958, but these were later found dead. Another pair in the Middle Sanctuary probably attempted to nest as they were seen collecting insects, presumably for nestlings, and seemed anxious when under observation (Teagle and Teagle 1959).

In the 1960 breeding season at least one singing male was present in Greenwich Park (Teagle pers. comm.). A nest contained six newly hatched nestlings on 1 June 1965 in the Large Sanctuary; they apparently fledged successfully and left the area by 24 June, but there were no breeding-season records in 1966. Intensive migration watches in Greenwich Park in the mid 1960s showed that the spring passage of willow warblers occurred between 7 April and 24 May (a maximum of 10 birds on 6 May 1965) and in the autumn passage from 23 July to 14 September (maxima of 16 birds on 12 and 20 August 1965) (Grant). In 1996–9 spring passage took place between early April and early May, with at least four birds singing in the Park on 12 April 1997 and a late bird on 10 June 1998. In the autumns, passage was recorded from 27 July (in 1997) until 10 October (in 1996) (Brown 1998, 1999, 2000).

At Blackheath, Owen, Hyatt and I frequently heard willow warblers singing on passage in large gardens around the Heath throughout the 1940s. On 29 May 1949 I located a pair which appeared to have a nest in the ground vegetation of the large wooded private garden of Woodlands, Mycenae Road.

Goldcrest *Regulus regulus*: Witherby reported that a nest had been found in Blackheath two or three years previously and that flocks of ten to twenty pass through the district in autumn and winter. However, it was recorded only once in Greenwich Park during 1896–1901 (Webster). In 1937, a correspondent of *The Blackheath Local Guide and District Advertiser* reported one in his garden in Westcombe Park Road, Blackheath. Goldcrests were still scarce when I arrived in 1943 and my records were: one in Greenwich Park on 18 December 1946; two in the grounds of Morden College, Blackheath, on 7 February 1947 after heavy snow; and one in a garden at Blackheath on 11 January 1948. They took several years to recover from the severe winter of 1946/7.

Goldcrests were next recorded in 1954 when they were seen on four occasions in Greenwich Park, in March, May, November and December (Brown and Phillips 1955), plus a single bird in October at Blackheath (Teagle 1997). On 16 February 1958 one was seen in a garden in Morden Road Mews, Blackheath, and up to five on various dates in the last three months of the year in Greenwich Park (Teagle pers. comm., Teagle and Teagle 1959). In 1959 and 1960 they were becoming frequent enough to be listed simply as occasional visitors to the Park (Teagle and Tinning 1962).

Grant recorded up to four goldcrests at a time in Greenwich Park's Flower Gardens on various dates in October 1964, 1965 and 1966, and also in late September and early November in 1966. On 5 June 1974 I encountered one singing near the Ranger's House. By the late 1990s they were established in the Park as breeding residents as well as on passage. A pair with two young was seen on 23 May 1997 and a group containing five or six young was seen on 18 July. In 1998 a pair reared at least two young in the Flower Gardens and may have raised a second brood (Brown 1999). A pair probably also bred here in 1999 as two young were reported on 21 June (Brown 2000). The goldcrest apparently now enjoys a stronger presence in Greenwich Park and the gardens around Blackheath than at any other time over the past hundred years.

Firecrest *R. ignicapillus*: apart from a vague reference by the GNHC to the occurrence of this species in the Blackheath district, there were no precise records until 1996 when Brown (1998) recorded the following in Greenwich Park: one on 5 April; two on 30 September; one on 5 and two on 10 and 15 October; and singletons on 16 and 30 November and 4 December. None was seen in the Park in 1997, but one appeared on 3 February that year close to Blackheath, in Granville Park, Lewisham (*LBR* **62**: 153). In 1998 one was discovered in a hawthorn below Flamsteed House, Greenwich Park, on 16 October (Brown 1999).

Spotted flycatcher *Muscicapa striata*: described successively as common in the Blackheath district (GNHC), several pairs present in the same area in summer (Witherby), and 'plentiful' in Greenwich Park (Webster). Rendall, writing of Blackheath between 1912 and 1937, stated that it nested around The Paragon. Barclay-Smith reported spotted flycatchers as present in Greenwich Park in 1928 and as breeding in 1929, with large numbers of young families in early August 1929. It continued to be a regular summer resident in the Park. In 1934, for example, it was the 'next most numerous summer migrant' after the willow warbler.

Several apparently breeding pairs continued to frequent Greenwich Park and the large gardens around Blackheath when I arrived in 1943. The vicinity of the Ranger's House and the trees around the Ranger's Field was especially favoured; the other principal breeding area encompassed the Wilderness, the Paddock and the Superintendent's garden.

In 1947 several pairs nested successfully and 'three (possibly four) pairs bred' in 1948 (Holroyde and Burton 1948, 1949). A similar number nested in 1949 (Owen and Burton 1950) and two, possibly four, in 1950 when 'juveniles were a feature of the shady walks in late summer' (Burton 1951). Breeding also took place in 1951 and 1952 (Burton and Hyatt 1953), after which an apparent decline set in. A pair or two were seen in 1953, but breeding was not proved, nor in 1954 although birds were 'quite numerous on occasions'. In 1958 Teagle, with intensive field-work, located three, possibly four, breeding pairs in Greenwich Park.

During 1960–4 a pair or two bred or were thought to have done so in Greenwich Park (Teagle et al. 1964; Tinning et al. 1966). Then intensive observations revealed five or six breeding pairs there in 1965, six in 1966 and five each in 1967 and 1968 (Grant 1967, 1970), so some breeding pairs may have been overlooked in previous seasons. Breeding still occurred in the Park in the late 1990s. A pair raised two or three young in 1996 (*LBR* **61**: 146). In 1997 up to three territories were established, but only one pair was known to have bred successfully, raising three young (*LBR* **62**: 154). Up to three breeding pairs were present in 1998 (Brown 1999), but in 1999 two territories were abandoned, while a family party present in high summer was considered to have come from a nest just outside the Park (Brown 2000). In the 1940s and 1950s apparent breeding pairs were occasionally noticed in the large gardens of houses around Blackheath.

Spring passage in the area in the 1940s–50s began about mid May, my earliest date being 11 May 1947; but Brown (pers. comm.) informs me that they seem to be arriving earlier nowadays: her arrival dates for 1997–9 being 7, 12 and 10 May respectively, and even one of 2 May has been mentioned to her. Autumn passage probably begins around the end of August. For instance, in 1963, when there was no definite evidence of breeding in Greenwich Park, 30 spotted flycatchers were counted scattered throughout the Park on 31 August (Tinning et al. 1966). One was seen as late as 29 September 1966 (Grant). The last dates in both 1997 and 1998 were 27 September (Brown 1999).

Pied flycatcher *Ficedula hypoleuca*: recorded at Blackheath in 1883 (Grinling) and at Greenwich in the 1890s, when a male was shot (Witherby), but not again in the area until 1954, when two were seen in Greenwich Park on two dates in August, while on 19 August there were at least two, probably four, in the Superintendent's garden (Brown and Phillips 1955). Since then, one or more have been seen on autumn passage in most of the relatively few years that the Park has been watched. Spring records in Greenwich Park are far fewer: a male in 'superb summer plumage' on 2 May 1968 (Grant 1970) and a male on 24 April 1996 (Brown 1998).

Long-tailed tit *Aegithalos caudatus*: recorded in the Blackheath district and in Greenwich Park by the GNHC and by Witherby, it was 'very plentiful in the wooded parts' of the south-east London/north-west Kent area at the turn of the century (Grinling) and was included by Webster in his Greenwich Park list for 1896–1901, though seen only once. Between 1912 and 1937 it was reported to breed at Blackheath (Rendall).

Hard winters in the 1940s, culminating in the very severe one of 1946/7, greatly reduced the long-tailed tit population and I did not see any until 1 November 1949, when I encountered a party of about 10 in Greenwich Park's Large Sanctuary. The next record for the Park was in 1957 (Phillips and Manser 1959) and three were seen in the garden of The Paragon on 3 October that year (Teagle 1997). In 1959 a party of seven was seen on 8 November in Greenwich Park by Tinning and Teagle. From 1960–2 they were said to be regular winter visitors but, following the severe winter of 1962/3, were not seen again until March 1967 when a party of seven occurred (Grant 1970). It was reported as a visitor in 1969, but not thereafter until 1974 when breeding was proved: on 5 June, on a rare visit, I met a large and vocal family party in the Rhododendron Dell, close to Chesterfield Gate. They were again thought to have bred in the Park in 1975, while nowadays a few pairs certainly do so (Brown 2000). For example, in 1998 young were fledged from at least two nests and a troop of 15–20 birds was seen on 12 May (Brown 1999), while in 1999 (LNHS *Orn. Bull.* 245) about 30 birds were present in late summer.

Marsh tit *Parus palustris*: considered an uncommon species in north-west Kent and south-east London by Grinling, the marsh tit had previously been recorded as a visitor to Greenwich Park (GNHC) and as an occasional visitor there during 1896–1901 (Webster). At Blackheath, Witherby said it was frequent in winter. At least a pair was breeding annually in Greenwich Park when I began visiting in 1943. In 1945, however, I wrote that 'the usual pair or two' had failed to nest. They also failed to breed in 1946, though I watched several feeding with other tits on 16 March and a party of six by the lake on 23 November. Also in 1946, I encountered several consorting with other tits at the edge of Blackheath on 22 December. A pair I saw in Greenwich Park on 11 May 1947 apparently constituted the last record until one was seen on 27 September 1961 (Teagle et al. 1964). In 1974 the marsh tit was listed as having been 'observed' (*BLRP* 1974). There appear to be no later records.

Coal tit *P. ater*: recorded in the Blackheath area in the first half of the nineteenth century by the GNHC and in the 1890s by Witherby and said to be 'sparsely distributed' in north-west Kent at the start of the twentieth century by Grinling. It was then breeding in Greenwich Park (Webster) and Rendall recorded it at Blackheath during 1912–37, but not nesting. In autumn 1937 it was reported in a Blackheath garden in a letter to *The Blackheath Local Guide and District Advertiser*.

From my first visits to Greenwich Park in 1943, I found coal tits breeding regularly there; at least a pair bred or probably bred annually. In colder months up to 1946 I often saw them feeding with flocks of other tits, but numbers declined sharply after the severe winter of 1946/7. From 1948–58 at least a pair nested annually, except for 1954, 1955 and 1957. Then a gap ensued, including the severe winter of 1962/3, until 1965 when three pairs bred, rising to four in 1966 (Grant 1967, 1968), dropping back to three in 1967 and 1968 (Grant 1970). From 1969–73, breeding was not proved, perhaps due to lack of observation as breeding was reported again from 1974. In 1997 a pair nested in the Flower Gardens and successfully fledged three or four young. A pair has bred each year since though few young survive (Brown 2000).

At Blackheath in the 1950s coal tits were scarce residents around The Paragon, in the grounds of Morden College and in Blackheath Park, but although frequent in the breeding season there was no proof of nesting (Teagle 1997). Nowadays, they are still heard in that area (Brown pers. comm.).

Blue tit *P. caeruleus*: long recorded as a breeding inhabitant of the Blackheath district, including Greenwich Park (GNHC, Witherby, Webster, Rendall, Barclay-Smith).

From 1943–53 inclusive my friends and I found nests or noted pairs of blue tits with fledglings every year in Greenwich Park and in the gardens around Blackheath. It has continued to be common ever since, as confirmed by Brown (1998, 1999, 2000). In Greenwich Park counts were made of 12 breeding pairs in 1965 and 1966 (Grant 1967, 1968). Counts by Teagle in 1958 and 1959 (Table 1) revealed a winter population in the Park varying from 4 to 48 individuals.

During 1953–8, Teagle (1997) found the blue tit common at Blackheath, although his only breeding record was of an adult feeding a brood of four near The Paragon on 9 June 1955. However, Hyatt told him that, during this period, a pair regularly bred in a nest-box in nearby Kidbrooke Gardens.

Great tit *P. major*: the early history of this species in the Blackheath and Greenwich area is similar to that of the blue tit. The eight breeding pairs located by Grant (1967, 1968) in Greenwich Park in 1965, with seven pairs in 1966, agrees with my impression of the breeding population in the 1940s and 1950s. Censuses made in the Park in 1958 and 1959 by Teagle (Table 1) show the winter population then varied between two and 11 individuals. The great tit remains the Park's second commonest tit (Brown 2000). At Blackheath, Teagle (1997) considered it a common resident when he lived there.

Nuthatch *Sitta europaea*: a probable breeding pair was reported at Blackheath in 1894 (Witherby) and it was recorded by Webster as breeding in Greenwich Park in 1896–1901. In the 1946/7 winter I regularly watched a pair in Greenwich Park, usually in the trees near the lake. On 10 March 1947 four were there. That year a pair was continually present and was believed to have nested (Holroyde and Burton 1948). A pair bred annually, or probably did so, in their favoured site up to 1953; thereafter breeding was not recorded again in Greenwich Park until 1975, although singletons were seen in 1958 (Teagle and Teagle 1959), 1960 (Teagle and Tinning 1962), 1965 and 1966 (two together on 18 January) (Grant 1967) and 1974 (*BLRP* 1974). Since its return to Greenwich Park as a breeding species in 1975 (*BLRP* 1975), the nuthatch seems likely to have remained as such. By the late 1990s it seemed well established. Several pairs were present in the 1996 breeding season, although no young were noted (*LBR* **61**: 150). In 1997–9 some three to five pairs were estimated to be present (Brown (1999, 2000).

Treecreeper *Certhia familiaris*: the only records of this species in this area before the end of the nineteenth century are the statement by Witherby that it is seen in summer at Blackheath and may breed, and the inclusion of it by Webster among the breeding species in his 1896–1901 list for Greenwich Park. Between 1912 and 1937 Rendall recorded it among the visiting species in his Blackheath list and Barclay-Smith reported that it was a winter visitor to Greenwich Park. By 1943 one or two together were a regular sight in the Park (on one occasion, 28 March 1953, Derek Goodwin and I saw at least six) and a pair at least was considered to breed annually until 1955 when none was seen at all. After that year only occasional birds were recorded most years until 1962 when a pair unsuccessfully attempted to nest behind the bark of a sweet chestnut tree in Bower Avenue (Teagle et al. 1964). Nesting did not occur again until 1965 when a pair was strongly suspected of doing so in the One Tree Hill area of the Park (Grant 1967, 1968) and again in 1967 (Grant 1970). In the 1970s, breeding was suspected in Greenwich Park in 1974 and 1975. An adult was seen with two juveniles in July 1996 and two other adults were seen (*LBR* **61**: 151). With three pairs present in 1997, breeding was suspected (*LBR* **62**: 159, Brown 1998). In 1998 two were seen only once but the pattern of singletons again suggested three territories. This probably continued in 1999. In that year a nest was noticed and two recently fledged young were being fed by two adults on 13 May (Brown 1999, 2000). The only record I have of treecreepers at Blackheath is of two I watched in the grounds of Morden College on 9 November 1947.

Red-backed shrike *Lanius collurio*: in the 1940s, this shrike was still nesting as near to Blackheath and Greenwich as Plumstead Marshes (now Thamesmead) and Sundridge Park, Bromley, so it was perhaps not that remarkable that a pair attempted to nest in Greenwich Park. On 15 June 1944 I was shown a nest containing four eggs in a holly near the Superintendent's House. Unfortunately, by 2 July, the nest had been partially destroyed and the eggs and the adults had disappeared. In earlier times red-backed shrikes nested on nearby Shooters Hill (GNHC, Witherby) and up to the mid nineteenth century, at least, Blackheath would have provided a suitable breeding habitat.

Jay *Garrulus glandarius*: although recorded in the Blackheath district in 1859 by the GNHC and in 1894 (two) by Witherby, it is not in Webster's Greenwich Park list for 1896–1901. It was then heavily persecuted by gamekeepers in north-west Kent. It occurred in the Blackheath district by the 1930s at least (Rendall) and several were present by then in Greenwich Park (Barclay-Smith). When I arrived in 1943 up to half a dozen pairs nested or probably did so in the Park in most years, although in some years there were only two or three pairs, possibly due to culling by the Park authorities. In 1958 only one pair was known to nest: in a tit nest-box from which the lid had been dislodged; it was eventually robbed by children (Teagle and Teagle 1959). One pair was recorded in the 1966 breeding season, although there had been six or seven pairs present the previous year; however, only one nest was located and no young were seen (Grant 1967, 1968). 'Small numbers' bred in 1967 and 1968 (Grant 1970). During a visit on 4 September 1975 I watched four mobbing a tawny owl in the Large Sanctuary, a year when jays were thought to have bred there. Nowadays, one or two pairs are believed to be resident in the Park, breeding in it or near by. In the autumn up to ten, including juveniles, collect acorns (Brown 2000). In 1958 and 1959, counts in late autumn and winter (Table 1) indicated a similar population at that time in Greenwich Park of up to nine birds.

As well as by human beings, the Park's jays were often harried by carrion crows: for instance, a pair with a single nestling in a nest in the Wilderness in 1949 was engaged in frequent pitched battles with a pair of carrion crows which tried to take the young jay. These crows were known to have robbed another jay's nest (Owen and Burton 1950). One adult jay was even killed by one of a pair of nesting carrion crows in the Flower Gardens on 31 March 1953.

In the 1940s and 1950s, Owen, Hyatt and I, and later, Teagle, often saw jays in the large gardens and on bomb-sites around Blackheath; presumably pairs nested, occasionally at least, in suitable sites. They are common around Blackheath today (Brown pers. comm.).

Magpie *Pica pica*: mentioned by the GNHC as a former inhabitant of the Blackheath district, up to the early years of the twentieth century the magpie was all but exterminated in north-west Kent (Grinling) and was not listed for Blackheath by Witherby nor for Greenwich Park by Webster. It was, moreover, not in the list of birds seen in and around The Paragon at Blackheath between 1912 and 1937 by Rendall, but a correspondent to *The Blackheath Local Guide and District Advertiser* of 4 December 1937 stated that he had once seen one. About this time one appeared in Greenwich Park and Barclay-Smith reported that by 1938 the magpie had become a permanent resident and was usually to be seen accompanied by one of the jays. Apparently only one bird was involved.

I did not see a magpie in Greenwich Park until 4 April 1946, when one flew low over the Wilderness. On 31 October 1953 Hyatt watched one fly south over Kidbrooke Gardens, Blackheath (Teagle 1997). On four dates in November 1958, Teagle (pers. comm.) saw a very bold magpie in the southern part of Greenwich Park which he considered to be an escapee. Two in the Park in November 1962 were thought to have been artificially introduced. However, on six dates in the autumn of 1964, 12 genuinely wild magpies were reported in the Park, with a maximum of 5 on 30 October (Tinning et al. 1966, Grant 1967). In 1965 single birds were present on 8 and 13 September and 8 October. In 1966 one or two were seen from 23 July until the end of the year (Grant 1967) and at least two in 1967 from September (Grant 1970), but from then not again until 1970 were magpies occasionally reported in the years following. In 1975 a pair was thought to have bred. By the mid 1990s a minimum of five pairs were believed to be breeding throughout Greenwich Park and it is now common throughout the Blackheath area (Brown 1998, 1999, 2000).

Jackdaw *Corvus monedula*: reported by the GNHC as 'common formerly' in the Blackheath district, Webster included it as a breeding bird in Greenwich Park during 1896–1901. On the other hand, Hudson (1898) stated that it had bred in the Park in recent years, but had disappeared. I feel more inclined to believe Webster, especially as Witherby stated that jackdaws had increased considerably, 'of late years', Rendall included it in his 1912–37 Blackheath list but could not confirm breeding.

In the 1940s I occasionally saw jackdaws at Blackheath and in Greenwich Park. The nearest breeding colony I knew was in the old trees around Charlton House, Charlton Park, two kilometres to the east. After 1947, I did not see any in Greenwich Park until 1949; thereafter they continued to appear in the Park and at Blackheath, usually singly or in pairs in company with carrion crows or rooks outside the breeding season. In July

1951 I noticed a pair frequenting Georgian houses at Vanbrugh Park and suspected nesting there. In 1952 a pair or two were definitely nesting in old trees in their gardens. By 1953, a small colony had become established from which birds were often seen feeding in adjacent Greenwich Park and in the nearby Vanbrugh Pits.

In 1954 jackdaws were believed to have nested in Greenwich Park and in 1955 at least two pairs were using holes in elms near the Magnetic Observatory. In 1956 three pairs nested at this site (Phillips and Manser 1957). By 1958, breeding pairs had spread to occupy 'natural holes in trees in a number of widely scattered areas; at least four, possibly seven, pairs nested, and in mid June, a noisy flock of as many as 30 birds was sometimes seen over the Flower Gardens and Wilderness' (Phillips and Manser 1959).

Subsequently, the jackdaw became a well-established breeding bird in Greenwich Park. At Blackheath it was established in the Vanbrugh Park area, in South Row by Prince of Wales Pond and probably in the grounds of Morden College. By 1965, nine pairs were known to breed in Greenwich Park and six pairs in 1966. The drop in the latter year was attributed largely to the felling of an old sweet chestnut tree in the Superintendent's garden which had held two breeding pairs in 1965. The main breeding stronghold was in the Flower Gardens and the Wilderness (Grant 1967, 1968). Jackdaws were still breeding in the Park when records ceased in 1975 (*BLRP* 1975). During a visit to Blackheath on 30 June 1989, I saw several feeding in the Vanbrugh Pits which, judging by the date, may have been breeding near by. One or two were occasionally seen in the Park in 1996 (after a long absence). In 1997 they were seen more often and a pair may have nested in the lake/Wilderness area, as a juvenile was seen with two adults on 10 June. In 1998 birds were watched collecting nest material, but no young were recorded. In 1999 at least one fledgling was seen and at least two other pairs were present (Brown 1998, 1999, 2000).

The former resident breeding population of jackdaws at Blackheath and Greenwich Park was usually augmented in the winter (see Table 1) by arrivals from elsewhere; for example, counts on Blackheath were 26 on 26 February 1957; up to 38 in January and February 1958; 35 on 31 January 1959 and 28 on 16 December 1961 (Teagle 1997), while I noted at least 15 in the Wilderness/lake area of the Park alone on 1 March 1959 and Grant recorded 25–30 birds present on Blackheath and in the Park on 14 January 1966.

Rook *C. frugilegus*: the earliest reasonably precise record of the rook in the area is Witherby's remark in 1895 that it was 'becoming rather too numerous of late'! Webster included it in his list of birds visiting Greenwich Park over the years 1896–1901 and at about the same time, J.W. Tutt remarked that there were 'plenty still on Blackheath, Westcombe Park, etc.' (Grinling). Rookeries flourished at that period as near Blackheath as Lee and the Woolwich Repository grounds (30 nests in 1907) and Rendall included the rook as a breeding species in his Blackheath list covering the years from 1912–37, but I suspect that they ceased breeding here well before the latter date.

From 1943, when my observations began, I frequently saw quite large flocks of rooks on Blackheath, from early October until mid March, consorting with gulls. By 1950 numbers were smaller, not usually more than seven, although I did count 20 on 28 October 1950 spread over the Heath and the adjacent part of Greenwich Park. I suspected them of coming from rookeries east of Shooters Hill, rather than the small Lee Green rookery which, in any case, died out in 1947. After 1953 no further records are known until 1964 when Grant (1967) watched small numbers flying over Greenwich Park on migration in October and November. Three flew over low to the west in March 1965 and some flew with other corvids in November 1966, and again in 1967 (Grant 1970). Rooks were recorded as winter visitors in 1975 (*BLRP* 1975), but there are no recent records (Brown pers. comm.).

Carrion crow *C. corone corone*: gamekeepers in north-west Kent kept this species very scarce up to the Second World War, although it was recorded in the Blackheath district by the GNHC and Webster. Webster reported, however, that it had ceased to breed in Greenwich Park by 1901, following the opening of the Park to the public. Rendall apparently failed to see the carrion crow at Blackheath between 1912 and 1937, but found it nesting 'a few miles away'. During the Second World War the population began to recover and I found the carrion crow quite plentiful in the Blackheath–Greenwich area when I moved there in 1943. By 1946, I was quite used to seeing family groups feeding in the open grassland of Blackheath, with a few pairs at least nesting in tall trees in large gardens around the edges of the Heath. From 1953–8 Teagle (1997) recorded a breeding pair in a tree in Blackheath Park.

In Greenwich Park in 1947 I found a pair nesting in a tall tree near the Queen's House. Breeding was next recorded in 1953, although a pair nested just outside the

Park in 1949 and frequently clashed with the breeding jays (Owen and Burton 1950). In 1953 two out of three pairs resident in the Park nested, one of them raising young. In 1954 two pairs nested (Brown and Phillips 1955). Subsequently, one or more pairs bred annually in the Park; in 1958 and 1965 four pairs attempted to nest (Teagle and Teagle 1959, Grant 1967). Nowadays, although a lot of young birds are seen in the Park, it is not clear how many breed in it; not many nests are noticed (Brown 2000).

Since 1946, the number of carrion crows observed outside the breeding season has been increasing. I wrote of Greenwich Park in 1950 that 'parties of up to 20 are now a familiar sight in autumn and winter, and in the early spring months. Eleven were present as late as 6th May, and were seen later in the day crowded together in adjacent trees just before dusk as though preparing to roost there.' (Burton 1951). However, numbers were more modest when winter counts were made in 1958 and early 1959 (Table 1).

In the mid 1960s, Grant saw as many as 40 spread out over Blackheath and Greenwich Park on 15 February 1966 and, during migration watches in the Park, recorded as many as 63 flying west on 30 October 1964. In a previous year, 1958, I carried out a migration watch from the high point by Wolfe's statue on 25 October and at 10.58 a.m. watched a flock of 12 fly in from the north-north-west at a great height, losing altitude as they crossed the Park. On 15 July 1989, while crossing Blackheath at 8.10 p.m., I saw a 'loose' flock of 70–80 feeding on open grassland near the Chesterfield Walk entrance to Greenwich Park. By the 1990s even larger flocks were being reported on Blackheath: e.g. *c.*300 on 13 September 1992 (*LBR* 57: 114) and 100 on 18 July 1996 (*LBR* 61: 154). According to Brown (2000), 'hundreds' move between the southern half of Greenwich Park and the open Heath. 'They use the trees all along the Charlton Way edge of the Park and feed on Ranger's Field, the grass between the Flower Garden and the bandstand and in the Flower Garden/Deer Enclosure. They are attracted by the food brought by visitors, primarily for the water birds, pigeons and squirrels.'

Predation by carrion crows on other species nesting in Greenwich Park sometimes caused the authorities to attempt to control their numbers. They were known to take mallard ducklings and blackbird nestlings, and were strongly suspected in 1949 of robbing jays of their eggs and young. In 1953, one killed a sickly adult jay (Burton and Hyatt 1955).

Hooded crow *C. corone cornix*: up to the early years of the twentieth century this race of the carrion crow was a regular winter visitor in small numbers to north Kent and was seen on Blackheath and in Greenwich Park, and on Greenwich Marshes (north-east of Greenwich Park) (GNHC, Witherby, Webster, Grinling). A contraction eastwards in its main winter range subsequently led to it becoming rare in the north Kent and London areas, and so it remains. I know of only two fairly recent records from Blackheath: one on 30 May 1967 (*LBR* 32: 44) and another on 27 April 1989 (*LBR* 54: 104).

Starling *Sturnus vulgaris*: stated by Witherby and by Grinling to breed commonly everywhere in the Kentish suburbs of London. Webster listed it as breeding in Greenwich Park in 1896–1901. In the 1920s and 1930s it was still common at Blackheath (Rendall), as was also the case when I arrived in 1943: they nested everywhere in suitable breeding sites at both Blackheath and in Greenwich Park. Outside the breeding season large flocks were common: for example, on 14 January 1944 I noted that large numbers were consorting with gulls and rooks on the Heath and on 16 March 1946 'vast' flocks were feeding in the early morning on the wartime allotments in the north of the Park, close to the Queen's House. Owen and I recorded large flocks feeding on Blackheath on occasions from 1947–53, as did Teagle (1997) from 1953–61; his maximum count for the whole Heath was 780, including one flock of *c.*400. Censuses of the winter starling population in Greenwich Park in 1958 and 1959 are set out in Table 1. Grant also made counts on Blackheath, his maximum being 1,500 on 14 October 1964; with the highest numbers in October and November and from mid February to March. Grant regularly observed starlings on migration in the autumn from 1964–6 flying west or north-west over Greenwich Park; his maximum was 3,200 on 19 October 1964. Numbers are much smaller nowadays: in November 1998, 200–300 were seen moving west over Blackheath on the 5th and 6th, and 700 on the 7th (LNHS *Orn. Bull.* 241). Like Teagle and myself in the 1940s and 1950s, Grant observed that the high trees around the ornamental lake and those in the Wilderness were used as the main staging-post by birds *en route* to the then central London roosts. He recorded the peak gatherings in November; for example, counting 2,300 heading north-west towards dusk on 21 November 1966.

Many pairs of starlings breed annually in Greenwich Park. As pointed out by Grant, the aged sweet chestnut and other trees which abound in the Park provide numerous nest sites; he put the breeding population in the mid 1960s at an absolute minimum of 100 pairs, a figure with which I would agree as the minimum for the 1940s and 1950s. Though common, fewer breed now (Brown pers. comm.).

In May and early June, several hundred adult and juvenile starlings used to join house sparrows and chaffinches searching the foliage of the oaks, limes and other trees for the larvae of the winter moth *Operophtera brumata*, green oak roller *Tortrix viridana* and other species of moth which are abundant at this time (Burton and Hyatt 1953). Starlings often fell victim to the sparrowhawks which used to breed in Greenwich Park. I saw several mobbing a sparrowhawk on 11 May 1948 and one harrying a little owl in the Wilderness on 21 November 1948.

House sparrow *Passer domesticus*: described by Grinling as abundant everywhere. Webster recorded it as breeding in the Park and Rendall as breeding at Blackheath in 1912–37. It was still very numerous when I lived in the district from 1943–59.

Like the starlings, house sparrows nested in holes in the ancient trees of Greenwich Park, including the ivy-covered Queen Elizabeth's Oak until it toppled over in 1991. Grant put the annual breeding population at an absolute minimum of 150 pairs, including *c.*40 pairs in Queen Elizabeth's Oak, an estimate which I believe was probably correct for most years since at least 1943. Also like the starlings, they systematically worked through the foliage of the oaks, limes and other trees in the Wilderness and elsewhere in May and early June for larvae of various defoliating moth species.

Complete censuses made in 1958 and 1959 by Teagle (Table 1) showed that house sparrow numbers in Greenwich Park varied in winter from 96 to 192. In his census area of the Park (the ornamental lake, Flower Gardens, Wolfe statue and Royal Observatory areas), Grant made some counts that suggested a population of *c.*250 in October/November 1964, 167 on 21 April 1965 and 178 on 17 May 1965.

Throughout the 1940s and 1950s, and probably up to 1991, large numbers of house sparrows used to roost in the comparative safety of the dense ivy that covered the long dead remains of Queen Elizabeth's Oak, and also in bamboos, privet hedges and rhododendron shrubberies by the Ranger's House. Grant observed roosting flights with starlings in the mid 1960s often involving large numbers, especially in October. He noted that the return flights from the north-west in the early mornings were more obvious than the evening exodus; they would gather in the hawthorns around the Observatory before flying on south-eastwards.

In the 1940s, in winter I frequently observed large mixed flocks of up to 200 or more house sparrows and linnets feeding in company with meadow pipits and skylarks on disturbed ground on Blackheath. Teagle (1997) continued to see large flocks feeding on the Heath in the 1950s, especially in late summer; on 14 August 1956, for example, when he surveyed the entire Heath, he estimated that *c.*450 house sparrows were present.

Nowadays, only small clusters are scattered through Greenwich Park (mainly near buildings and where visitors deposit food) and in the Blackheath area generally (Brown 2000 and pers. comm.).

Tree sparrow *P. montanus*: this sparrow was considered to be very localized as a breeding species in the Kentish suburbs of London at the beginning of the twentieth century (Grinling) and only a regular visitor to Greenwich Park (Webster). The Park's ancient trees, riddled with natural holes, offered plenty of nest sites, so I especially looked out for tree sparrows and succeeded in finding a few pairs (three in 1944) breeding in the years up to and including 1947. The statement in Holroyde and Burton (1948) that 'they were not seen by the Observer(s) in 1947' was untrue and only partially corrected in Holroyde and Burton (1949). As a teenager I was the junior Observer at that time and was not given the opportunity to read the reports before publication. In fact, I saw a pair several times and Owen and I located an occupied nest hole in the usual ancient sweet chestnut tree in the Flower Gardens on 12 May. We located another pair in another old chestnut tree near by which seemed to be occupying one of several holes. But neither of these pairs appeared to nest successfully and the last tree sparrow I saw in the Park was one in the Flower Gardens on 12 July 1947.

No more were seen in Greenwich Park until 1962 when at least one was reported and another in the spring of 1963 (Tinning et al. 1966). On 30 March 1965, three were seen flying high to the north-west and on 24 March 1966 a single bird was seen perched near the garden of the Royal Observatory (Grant). Visiting tree sparrows were again reported by Grant in 1967, 1968 and 1969. In 1974 and 1975 it was again on the Park's list of breeding birds (*BLRP* 1974, 1975), but no details were provided. Miss Patricia Brown tells me that she has not seen a tree sparrow in the Blackheath area since 1982 nor has she any records of it in Greenwich Park in the 1990s.

Chaffinch *Fringilla coelebs*: mentioned by Grinling as occurring in Westcombe Park on the eastern fringe of the Blackheath area and not included in the 1896–1901 list for Greenwich Park (Webster). However, Witherby stated that it 'breeds very sparingly here, but a considerable number visit us in the autumn and winter'. Rendall and other correspondents to *The Blackheath Local Guide and District Advertiser* in 1937 mentioned its occurrence at Blackheath in the 1920s and 1930s, whilst Barclay-Smith put it among species breeding in 'good numbers' in Greenwich Park.

Although chaffinches bred annually in Greenwich Park in the 1940s and 1950s, the number was surprisingly small in most years, probably not more than half-a-dozen pairs or so. When Grant made census transects the highest number of pairs he located in the breeding season was four. From 1968–70 he found no breeding pairs in the Park (Grant 1970, 1971), but probable breeding was reported again by the mid 1970s (Cramp 1975). From 1996–9 up to three males have been singing, sometimes with females present, but no young have been seen and usually no birds are noticed after the end of June (Brown 1998, 1999, 2000).

Outside the breeding season, chaffinches appear on passage and a few now winter in Greenwich Park in small groups or even flocks. On 19 October 1958 Teagle (unpub. notes) recorded 173 chaffinches passing over the Heath and the Park between 09.12 and 12.58 GMT, mainly in a north-westerly direction. All but twelve of these were over the Park. During regular visible migration watches from near Wolfe's statue, Grant observed autumn passage annually to the north-west or west from late September to mid November, but rarely more than 30 birds per hour. He also observed small directional movements, usually to the south-east, in February and March. The Park shared an influx of chaffinches with other parts of east London and Kent on 13 October 1997: some concentrated near the Henry Moore statue while others spread out all over the Park. Numbers dropped over the next two to three weeks, though sightings, usually of one or two, continued until the end of the year. An influx also took place on 20 October 1998, when the sycamores near Crooms Hill Gate and the Henry Moore statue were 'seething with ravenous birds'. Others fed in the Flower Gardens and along Lovers' Walk, whilst more flew westwards (Brown 1999). In November 1998, 40 were seen flying west over Blackheath on the 5th, 120 on the 6th and 240 on the 7th (LNHS *Orn. Bull.* 241).

Wintering chaffinches may be a relatively new development. Teagle (unpub. notes) saw none during his intensive period of observations from 1958–60 nor did Grant mention any. Nowadays, a few may be seen, e.g. feeding in sheltered spots along Lovers' Walk or in the deer enclosure (Brown pers. comm.).

Among observations of chaffinches I made over the years at Blackheath, I noted 'many' singing there on 6 April 1947, several feeding in the grounds of Morden College on 18 October 1947, several in the wooded garden of Woodlands, Mycenae Road, on 29 May 1949, and several on the Heath on 3 August 1953. From 1953–61, Teagle (1997) also heard them singing in the vicinity, including the grounds of Morden College.

Brambling *F. montifringilla*: the only record I have found prior to 1953 is as a winter visitor to Greenwich in the publication by the GNHC. Records since 1953 are:

1953: a male on ground being reinstated between Hare and Billet Road and Eliot Road, Blackheath on 31 March (Teagle 1997).

1958: five with other finches in a roost in rhododendrons in Greenwich Park's Flower Gardens on 26 February (Teagle and Teagle 1959).

1960: eight on 30 January with other finches in the same roost (Teagle and Tinning 1962) and 10 on the same date in the grounds of Morden College, Blackheath (Teagle 1997).

1964: in Greenwich Park on six dates between 13 and 29 October and, in addition, 47 flew west in one hour on 19 October during a large movement of chaffinches and other species (Tinning et al. 1966, Grant 1967).

1965: single birds in Greenwich Park on 17 and 27 October (Grant 1967).

1966: six flying west on 15 January and one east on 29 January, two seen on 23 September, one flying north-west on 21 October and two flying west on 8 November, all in Greenwich Park (Grant 1967).

1967–9: in Greenwich Park in all three years, including an unusual instance of one singing at the end of March 1968 (Grant 1970, 1971).

1997: one juvenile male (with chaffinches) in Greenwich Park on 13 October and a female calling in the south-west corner of the Park on 28 October (Brown 1998).

Greenfinch *Carduelis chloris*: Grinling referred to this as the commonest finch in the west Kent area. It was recorded as breeding in 1896–1901 in Greenwich Park (Webster), at Blackheath during 1912–37 (Rendall) and in 'good numbers' in Greenwich Park in 1938 (Barclay-Smith). When I began observations in the Park from 1943 the regular breeding population was perhaps half a dozen pairs.

None were known to nest during 1954–7 (Brown and Phillips 1955, Phillips and Manser 1957, 1959), but they bred again in most years from 1958 onwards. Four pairs were known to breed in 1965 and eight in 1966 (Grant). There were no positive breeding records in Greenwich Park in 1996–9, though it bred near by and adults appeared with young in August to feed on fruit and seeds around the Reservoir (Brown 2000).

In late January 1958, greenfinches roosted in 'quite exceptional numbers' with other finches in the Flower Gardens shrubberies in Greenwich Park. On 2 February 1958, during hard weather, at least 250, mostly greenfinches and linnets, thronged these shrubberies, the number dropping to about 30 by 26 February (Teagle and Teagle 1959). In 1996 up to 50 roosted in the Park until April (*LBR* **61**: 160). Sites included trees east of the Superintendent's garden and in the south-west corner of the Park. Small roosts continue. Most roosting greenfinches arrive from outside the Park. On winter days a few may be seen in the Park. Winter counts made in 1958 and 1959 are in Table 1. Nowadays, numbers would not normally be very different (Brown pers. comm.).

At Blackheath I often heard greenfinches singing in the grounds of Morden College in the 1940s and 1950s, as did Teagle (1997) in later years, and also around the now defunct Round Pond and in large gardens bordering the Heath. They continue to be common around the Heath (Brown pers. comm.).

Goldfinch *C. carduelis*: listed by the GNHC as occurring at Blackheath in the mid nineteenth century and by Webster as a frequent visitor to Greenwich Park in 1896–1901, a period when it was considered one of the rarest breeding birds in the London Area. 'About 1907–08 it seems to have begun to recover, and by the middle of this [twentieth] century it had regained its apparent numerical strength of the middle of the previous century' (Homes et al. 1957).

The goldfinch was not included by Rendall in his Blackheath list but the Greenwich Park report for 1938 mentioned that goldfinches 'continue to be seen flying about the Park and there is no doubt that they also nest' (Barclay-Smith). I found Blackheath to be a stronghold of them in the 1940s: males sang in trees growing on bomb-sites and in gardens of large houses surrounding the Heath as well as in the willows and other trees fringing the former Round Pond, off Pond Road. In May 1948 I watched a pair in a garden hawthorn close to the busy traffic around the Royal Standard on the eastern side of Blackheath.

In 1953 goldfinches were 'well established, not only around The Paragon, but also around Blackheath Station and to the south of Blackheath Hill' (Teagle 1997). He also saw fledged young in the area on three occasions. During a visit to Blackheath on 30–31 August 1983, Owen and I saw one in a tree on Whitefield's Mount, several in the willows bordering Folly Pond and Prince of Wales Pond, plus a pair feeding fledglings in a hawthorn in the gorse area of Vanbrugh Pits. On 30 June 1989, I watched several in the latter area. According to Brown (1999), small flocks continue to visit the open parts of Blackheath to feed on seeds.

My friends and I often saw goldfinches in Greenwich Park, but it was thirty years after the 1938 report that breeding there was proved. Given that pairs had for long nested close by and that they and their fledged young often flew into the Park to feed, it was only a matter of time before proof was obtained. A family party in July 1966 was suggestive (Grant 1967). In 1968 four young fledged from a nest found in the Royal Observatory garden (Grant 1970). Breeding was suspected in 1969 (Grant 1971) but there were no reports until 1974 and 1975 (*BLRP* 1974, 1975). The present status of the goldfinch in Greenwich Park is uncertain. In March or April parties of 10 or so may appear briefly. In November to early December a party may feed for a few days on One Tree Hill (e.g. *c.*25 in 1998, half that number in 1999) — as I also noticed in winter in the 1950s (e.g. *c.*10 in birches on 1 and 15 February 1959). Otherwise sightings are intermittent, usually when they are active just outside the Park and commute in and out. In both 1997 and 1999 a bird was watched gathering nesting material, but nothing developed (Brown 1998, 2000).

Grant (1967) showed that small numbers of goldfinches pass through the Park on spring and autumn passage, mainly flying west in spring and south-east in the autumn. Previously, at 07.45 GMT on 10 October 1954, Rosemary E. Gault, the then Superintendent's daughter, had counted 46 flying together over their garden in the Park (Teagle pers. comm.).

Siskin *C. spinus*: recorded by Witherby in the Blackheath area and by Webster as a winter visitor to Greenwich Park during 1896–1901. I watched one feeding in an elm in the Park on 15 January 1947 in that notoriously severe winter. A male was picked up in weak condition in the Park during a snowstorm on 14 April 1966; it died later (Grant 1967). In mid December 1967 a party of five was seen in the Park and a singleton during April 1968 (Grant 1970). A party of ten flew over on 30 October 1969 (*LBR* **34**: 60, Grant 1971), and in 1974 and 1975 siskins were reported on passage without any details being given (*BLRP* 1974, 1975). Brown (1998) reported that they had been seen flying over the Park in October 1997.

Linnet *C. cannabina*: the typically heathland bird to survive longest as a breeding species on Blackheath. It was present on 'all furzy commons' in the Kentish suburbs of London in the ninteenth century (GNHC) and continued to breed at least up to the late 1950s. This was 'the only heathland species that remained faithful to Blackheath despite the transformation of most of it into an urban green desert' (Teagle 1997). It was listed as breeding in Greenwich Park during 1896–1901 (Webster) and at Blackheath between 1912 and 1937 (Rendall).

By 1943, wartime neglect had allowed the vegetation on the 'wilder' parts of the Heath to flourish. Thus, I found linnets quite numerous throughout the year in the 1940s. Numbers fell after 1952 when reclamation and resowing of the formerly rough areas began. Until then it was not uncommon from late summer through the autumn and winter to see mixed flocks of up to 200 linnets and house sparrows (about half of each) on such terrain, feeding with skylarks. Teagle (1997) continued to see large winter flocks of linnets up to the 1959/60 winter. From early spring till mid May in the 1940s, flocks of 20–40, sometimes much larger, were often on weed-covered ground on Blackheath. Teagle recorded flocks on the Heath in March and April from 1954 to 1960, many of them feeding in the grass of football pitches and the lawn of The Paragon. Some were especially large (e.g. 150+ on 4 March 1954, 99 on 9 March 1954 and *c.*80 on 18 April 1960), and he thought (correctly, in my view) that they were probably on passage. Alas, by 1999, only four or five could be seen — in mid April. As a result of his observations in Greenwich Park in 1965 and 1966, Grant concluded that the period of spring passage was from the end of March to mid May, and that there was a smaller autumn movement during September and October.

In the 1940s and 1950s, at least a few pairs of linnets undoubtedly nested annually at Blackheath, especially in the large gardens around the Heath, as in Vanbrugh Park. In 1944 I found a nest with eggs in the foliage of a tall, stout plant on the edge of gun emplacements in a corner of the Circus Field, close to Greenwich Park. Teagle (1997) reported finding a nest in gorse in Vanbrugh Pits in 1957 and located breeding pairs elsewhere in Blackheath that year. During a brief visit to the Heath on 30 June 1989 I noticed that a few linnets still frequented the Vanbrugh Pits. Brown (1998) thought that sightings in early August 1997 within Greenwich Park suggested breeding in the vicinity.

In Greenwich Park, on 15 April 1948, I watched a pair of linnets investigating holly trees near the Ranger's House as if intending to nest there and in 1953 from 31 March to May a pair established themselves in the Wilderness and appeared to be breeding there, the male singing persistently. In May 1954 a nest with two eggs was discovered in a yew *Taxus baccata* hedge behind the war memorial, very close to the gorse area of Vanbrugh Pits (Teagle 1997). Unfortunately, this nest was deserted, due possibly to the burning of the nearby gorse (Brown and Phillips 1955). A few years later, on 8 June 1958, Teagle (unpub. notes) saw a well-fledged juvenile, with a developing tail, on the fence between the then plant nursery and the Wilderness, and two adults near by.

Redpoll *C. flammea*: recorded as a winter visitor in small flocks to the Blackheath district in the nineteenth century (GNHC, Witherby) and to Greenwich Park in 1896–1901 (Webster). On 6 March 1947 Owen and I found 15 feeding together with a pair of bullfinches in a birch in the Wilderness in Greenwich Park. On 26 January the next year I watched 18 in the trees around the Park's lake; by the following day they had gone. Two were detected amongst migrating chaffinches on 3 October 1960 (Teagle and Tinning 1962). During 1964–6 Grant saw 33 on migration over the Park in October and 4 in November 1964; totals of 17 from March to May 1965 and 11 from September to November 1965; 12 from March to May 1966 and 37 from September to November 1966. He also noticed redpolls on passage over the Park during 1968–70. Brown (1998) reported that one was calling above the Flower Gardens in Greenwich Park on 12 April 1997 and others flew over in October.

Common crossbill *Loxia curvirostra*: occasionally recorded by Webster in Greenwich Park during 1896–1901. Blandford (1937) reported that one June some 20 to 25 years previously, when living at The Paragon, Blackheath, he found a dead male crossbill entangled in a strawberry net in his garden. This record falls within a period of relative frequency mentioned by Homes et al. (1957), that of 1907–14. The biggest invasion took place in 1910 when no less than six pairs bred at Bostall Woods, east of Woolwich: so Blandford's crossbill may have died that year.

In the huge irruption of 1966 Greenwich Park received, to quote Grant, 'its fair share': twelve were seen at the top of a willow tree by the lake on 5 July and then, from 12 July to 17 September, at least 31 were observed, either in trees or flying over. Twenty-one of these flew off or were flying over to the north-west. According to Grant, the dates of nearly all occurrences in the Park coincided remarkably with renewed influxes at Dungeness, Kent. In 1967 one was seen flying west on 2 July (Grant 1970) and in December 1974 a party of three (two males and a female) was watched in Greenwich Park (*LBR* **39**: 60).

Bullfinch *Pyrrhula pyrrhula*: this species was known by Webster to breed in Greenwich Park from 1896 to 1901. Barclay-Smith saw her first bullfinches in the Park in 1931: a juvenile being fed by an adult male on 30 August. No nest was found, but as Teagle (unpub. MS) commented: 'it is fairly safe to assume that breeding took place within the Park boundaries'. Barclay-Smith then recorded the bullfinch annually and either considered or implied that a pair at least nested, remarking that in 1937 they 'were more in evidence than ever before'.

I had to wait until 6 March 1947 before I encountered bullfinches in Greenwich Park: a pair feeding with 15 redpolls in a birch in the Wilderness, when the trees were covered with frozen snow! Perhaps the Park's resident bullfinches were shot during the war as a pest of wartime pea and fruit growing. In 1949 a male was seen near the lake on 5 February and probably the same bird was watched on 15 June removing insects from *Delphinium* flowers (Owen and Burton 1950). The next were a male in the former plant nursery adjoining the Wilderness in October 1952 (Burton and Hyatt 1953), another male in the nursery area on 22 June 1955 (Phillips and Manser 1957) and a single bird (sex unspecified) seen by Teagle on 26 October 1957.

In 1958 a pair of bullfinches was recorded nesting in Greenwich Park for the first time since before the war and successfully reared two broods in the Wilderness (Teagle and Teagle 1959). By early November that year two males were being seen together and by 22 November as many as three males together, plus three females. Other counts made that winter are given in Table 1. A pair was thought to have attempted to nest in 1959, but not 1960, although two males and two females were observed in April and a pair frequented the Rock Garden in August (Teagle and Tinning 1962). Bullfinches continued to be encountered in 1961–4, but breeding was not proved again in the Park until 1965–8, when up to two pairs were present during the breeding season annually, at least one of which bred successfully each year (Grant 1967, 1968, 1970). A gap followed, but breeding was strongly suspected again in the mid-1970s (*BLRP* 1974, 1975). Unfortunately, when observations began again in the late 1990s there were no bullfinches in the area.

Published reports of bullfinches at Blackheath are almost non-existent since the GNHC and Witherby reported that they occurred there as occasional visitors. Rendall did not include the species in his list, though another correspondent to *The Blackheath Local Guide and District Advertiser* (20 November 1937) stated that she had seen a male in her garden in Hervey Road, Blackheath. I never saw them at Blackheath when I lived in the area and neither did Teagle during 1953–61. But by the 1970s and up to the 1980s there were two or three sites south and east of The Paragon, including the railway cuttings, where a singleton or a pair was often seen. The last record was on 2 December 1995 (Brown pers. comm.).

Hawfinch *Coccothraustes coccothraustes*: since Witherby reported that a flock had been seen at Greenwich in the 1890s and Webster mentioned once seeing this species in Greenwich Park during 1896–1901 the only record is of a pair seen calling in a high tree near the Ranger's House in Greenwich Park on 9 May 1960. They were not seen again (Teagle and Tinning 1962).

Yellowhammer *Emberiza citrinella*: this bunting was unreported in the area until Witherby stated that it was an occasional visitor to Blackheath and Webster listed it as a non-breeding visitor to Greenwich Park in 1896–1901. It was not recorded again until 25 March 1954 when a male was seen flying near General Wolfe Road in the north-western part of Blackheath, shortly after a small flock of linnets had passed (Teagle

1997). On 23 March 1958, Teagle saw a party of two males and three females on One Tree Hill in Greenwich Park, apparently in a hard weather movement which brought them and other migrant species into several central London parks, and on 22 April another yellowhammer was seen (Teagle and Teagle 1959). Next, one was sighted in Greenwich Park on 6 January 1962, and a party of eight stayed from at least 4 to 10 March (Teagle et al. 1964). Grant (1967) watched one fly south-east over the Park on 6 November 1964, one fly north-west on 19 March 1965 and one feeding below Wolfe's statue on 30 March 1965, plus another feeding in the same place on 27 April 1966. Thus, March and April seem the most likely months for yellowhammers in the area. An unusual sight in April 1968 was a male singing near Wolfe's statue (Grant 1970). That, as far as I am aware, was the last one reported.

Reed bunting *E. schoeniculus*: the only records are of a female by the ornamental lake in Greenwich Park on 5 April 1965 and a male in the Flower Gardens there on 4 October 1966 (Grant). It is perhaps worth mentioning here that in 1949 I found a pair nesting in Greenwich Marshes, only a mile or so from the Park.

Corn bunting *Miliaria calandra*: according to the GNHC, this bunting was an inhabitant of Blackheath in the mid nineteenth century and, rather surprisingly, Webster listed it as breeding in Greenwich Park as recently as 1896–1901. I have not heard of any later reports of it in the area.

Discussion

Despite its present-day isolation from the countryside, Blackheath and Greenwich Park still support a good diversity of wildlife. As I have set out in detail in the foregoing survey, twenty-nine species of mammals, reptiles and amphibians (including those square-bracketed), and 138 species of birds, including established aliens, have been recorded in the Blackheath and Greenwich Park area between about 1850 and 1999. Of the twenty-six species of mammals, reptiles and amphibians said to have occurred between 1850 and 1901, fourteen at least were definitely or thought to be still present in the 1940s and 1950s. Of these 14, one — the rabbit — became extinct by 1944, and another — common lizard — was artificially introduced in 1946. In addition, two species of bat — Daubenton's and noctule — not recorded prior to 1901, but presumably present, were subsequently reported in the area and the alien grey squirrel was introduced, bringing the species total for the 1940s–1950s to seventeen.

Of the 141 species of birds, including *established* aliens, recorded in the area covered by this paper between about 1850 and 1999, seventy-one of which are known or believed to have bred, or attempted to do so, at least once, 131 have been recorded since 1901 (sixty-four of which bred at least once). Since the complete encirclement of Blackheath and Greenwich Park by urban development from 1948, sixteen species of mammals, reptiles and amphibians, and 123 species of birds, have been recorded, of which fifty-three of the birds have bred at least once. Figure 11 plots graphically the number of species of birds known or believed to have bred annually in Greenwich Park in the years 1944 to 1970 inclusive, plus 1974, 1975 and 1996–9. For comparison I have also included the total of breeding species recorded in the Park by Webster over the six-year period 1896–1901.

The graph (Figure 11) clearly shows the decline which set in after 1945 when post-war reconstruction got under way, especially when the housing developments mentioned above began in earnest from 1948 to infill the remaining open areas between Greenwich Park and the Kentish countryside. However, from that year up to at least the end of the 1960s it will be seen that the total number breeding annually stabilized at around twenty-six species, allowing for those years when observer coverage was known or strongly suspected of having been less intensive and complete. In these years, judging by those in which coverage was known to have been very good (e.g. 1948, 1949, 1951, 1952, 1958, 1965 and 1966), it is likely that six to eight additional species, which were in fact breeding, were probably overlooked. Observer coverage was known to have been particularly inadequate in 1964 and 1970. No records of annual breeding totals were available to me for the years 1902–43, 1971–3 and 1976–95, but those that do exist since 1973 suggest that an improvement has been taking place with a few old nesting species returning (e.g. jackdaw) and some new ones (e.g. long-tailed tit) being gained. The observations of Brown (1998, 1999, 2000) indicate that at least thirty-two species are now breeding annually or attempting to do so in Greenwich Park, a total only once exceeded, to my knowledge, since 1947. It seems probable that the maturation of trees, bushes and other vegetation in the gardens of the post-war developments now facilitates the flow of birds between the Park and Shooters Hill. Isolation of an area through urbanization may thus cause only a temporary barrier to such interflow for many species, such as woodland birds like the nuthatch and woodpeckers, but a permanent barrier to others, such as those of open country like the grey partridge and the rook.

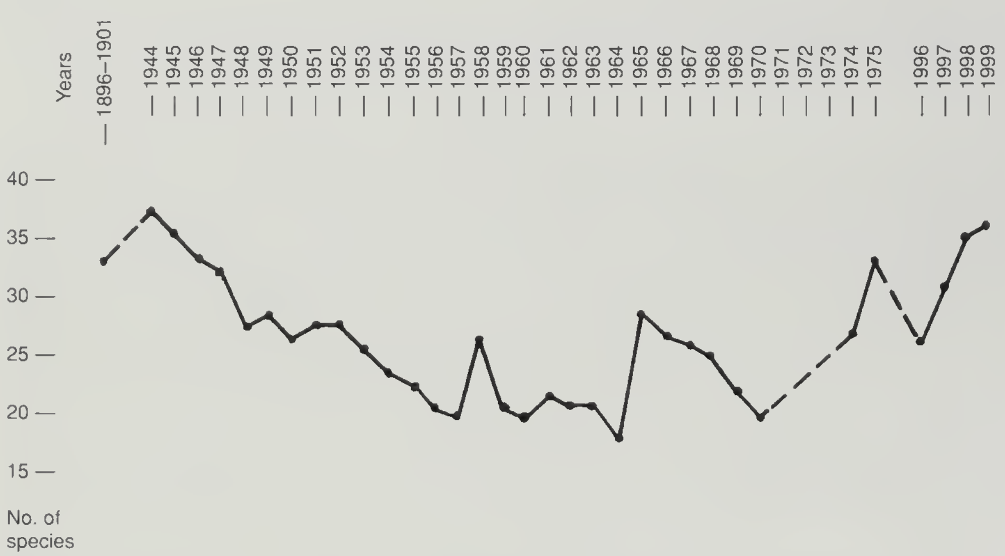

FIGURE 11. Annual totals of wild bird species breeding in Greenwich Park from 1896 to 1999. – – – indicates no totals available.

Both Blackheath and Greenwich Park are, of course, heavily used by the public and the accessible areas are much trampled upon, especially on public holidays and during such special events as the regular London Marathon. Nevertheless, it would be well worth making the effort to improve the wildlife interest of certain areas by employing conservation management techniques, especially in view of the growing public interest in wildlife and its conservation. In this respect Greenwich Park is well served by such long-established enclosures, from which the public is excluded, as the Wilderness deer enclosure, the adjacent bird sanctuaries, the old covered reservoir and part of the gardens of the former Royal Observatory; they provide secluded cover for breeding birds and mammals to say nothing of numerous invertebrates. In the public areas, the ornamental lake and its attractive surroundings, such as the Flower Gardens, are favourable to wildlife, but more could be done, perhaps, to enhance the wildlife interest of other parts of the Park without detriment to the public's freedom of movement. This is especially true of the Park's northern half, such as the area encompassing the former spring (attractive to migrant warblers and other birds) north-east of and below Wolfe's statue, One Tree Hill and the valley between them. Suitable measures could include allowing even more ground vegetation to grow naturally, with the minimum of control.

The wartime relaxation of intensive mowing on Blackheath, plus the colonization by a wide variety of ruderal plants of the surface of those gravel-pits infilled with debris from wartime bombing, demonstrated that such birds as wheatears, yellow wagtails and, particularly, skylarks could be encouraged to breed there again.

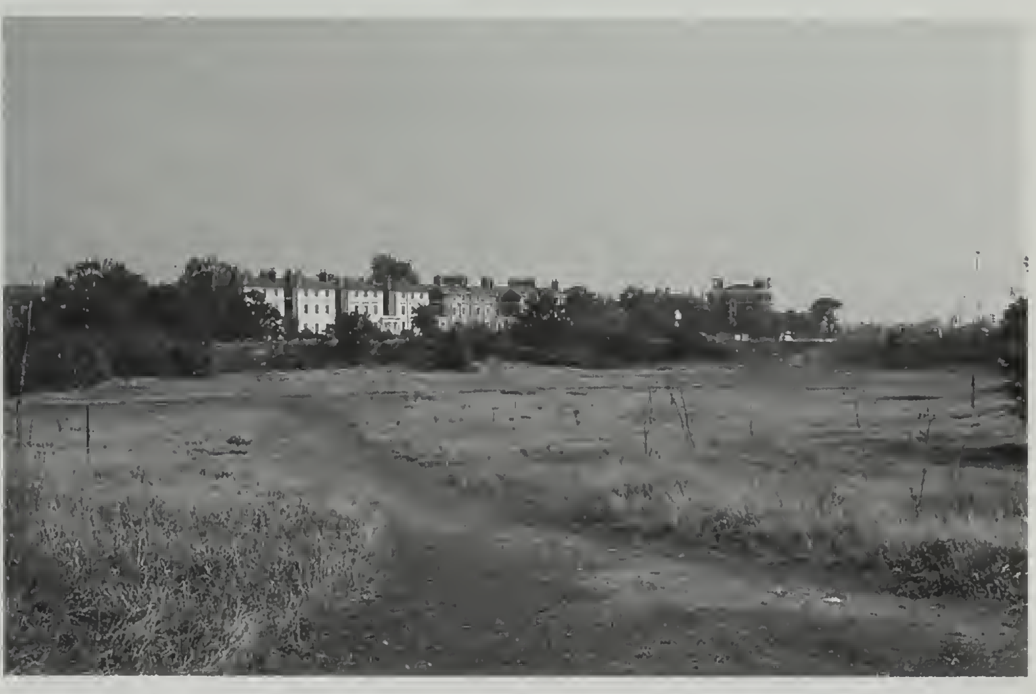

FIGURE 12. Acid grassland in the north-east corner of Blackheath, 7 September 1989.
Photo: J. F. Burton

It was therefore pleasing to learn from Teagle (1997) that the Nature Conservation Section of the London Borough of Lewisham, in co-operation with the London Borough of Greenwich and the London Wildlife Trust, is now managing as spring or summer meadows those grassed areas not maintained for public sports and similar recreation (Figure 12), mowing twice a year. Every effort should also be made to conserve Vanbrugh Pits and its relict heathland habitat, haunt of breeding linnets, and to protect it from the ravages of excessive bicycle riding and general vandalism, including arson. On the north-west side of Blackheath, Hyde Vale has the best example of surviving acid grassland on the Heath, as pointed out by Swales et. al. (1989), and should be protected for that reason. Another area worth improvement in the interests of wildlife is that encompassing Whitefield's Mount and Pond, Marr's Ravine and Hare and Billet Pond in the west-central part of the Heath.

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I am especially grateful to my friend W.G. (Bunny) Teagle for most generously making available to me a vast amount of his unpublished notes and other manuscripts concerning Blackheath and Greenwich Park; also for enthusiastically and painstakingly reading through a first draft of this paper and making many constructive criticisms, corrections and helpful suggestions which I have been glad to follow. My gratitude is due also to the late F.E. Birch who, as Superintendent of Greenwich Park in the 1940s, very kindly allowed me, though still a teenage schoolboy, the freedom to wander through the enclosed bird sanctuaries, the Paddock, the Wilderness and his garden, years before I was appointed by the then Minister of Works as an Official Observer for the Committee on Bird Sanctuaries in the Royal Parks. My thanks are due also to his successor, T.C. Barbour, who was also very kind and helpful. I am grateful, too, to my friends from schooldays, K.H. Hyatt and the late Dr D.F. Owen, who allowed me to make use of their notes, and also for their enjoyable companionship on many of my walks through the area. Tribute must also be paid to all the other Official Observers who, over many years, diligently reported on the birds of Greenwich Park to the Committee on Bird Sanctuaries in the Royal Parks; their names will be found in the list of references. My ability to bring this history more or less up to date is due largely to Miss M.P. (Patricia) Brown's admirable initiative in assembling a *Greenwich Park Bird Report*, published by the Friends of Greenwich Park, the first three of which cover the years 1996–9. I hope they will be followed by many more. She also answered many of my enquiries and supplied me with recent maps and information. Moreover, she bravely took on the task of painstakingly reducing to manageable proportions a second draft of this paper. It gives me great pleasure to express my sincere and grateful thanks. I am also very grateful to an unknown referee who made constructive and valuable criticisms of an earlier draft, and to Michael Egan for his timely discovery of H.F. Witherby's account of the birds of Blackheath in 1895 which I was completely unaware existed.

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Finally, I dedicate this work to the memories of the late Peter James Grant, whose excellent and valuable account of the bird-life of Blackheath and Greenwich Park in the mid 1960s was published in *LBR* **31** (1967), and to my late friend from schooldays in Greenwich, Dr Denis Frank Owen, whose name also often appears in this paper.

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Postscript

Whilst this paper was in press, the report on the birds of Greenwich Park for 2000 (Brown, P. 2001. *Birds of Greenwich Park 2000 and Summary 1996–2000.* Friends of Greenwich Park) was published. Again, seventy species were recorded, at least thirty of which definitely bred or are thought to have done so. The more unusual visitors were the first teal since 1965, a drake on the Flower Gardens lake on 5 November; a hobby flying west on 17 May; an oystercatcher flying south on 21 August; a great black-backed gull flying over on 23 September, the first in the area since 1966; a common tern flying over towards the Thames in mid July; the first kingfisher recorded in the Park since A. D. Webster's time, which flew through the Flower Gardens on 25 September; a redstart on 18 July, and a reed warbler on 30 May, the first since 1966. Among the more usual species, ring-necked parakeets are reported to be becoming resident in the Park.

Strandings of Royal Fish (Mammalia: Cetacea) in Greater London

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Abstract 99
Historical background 99
Methods 99
Strandings recorded from Greater London, 1913–2000 101
Discussion 105
Acknowledgements 106
References 106

Abstract

Naturalists are reminded that whales, dolphins and porpoises (mammals belonging to the order Cetacea) can be found swimming in the Thames and other large rivers as well as in the waters around our coastline. These animals, when found on the shore or caught in inshore waters are, in most cases, legally designated 'Royal Fish' and cannot be disposed of without the permission of the Receiver of Wreck. The Natural History Museum has first claim to such carcases and should be contacted as soon as possible. Cetacean deaths in Greater London from 1913 to 2000 are listed with comments.

Historical background

In 1324, a statute was enacted giving the sovereign (Edward II) the right to all cetaceans stranded on, or caught in the waters around, the coasts of England and Wales (Fraser 1977). The situation has become more complicated since that time, with certain Lords of the Manor being granted legal rights to cetaceans washed up on their shores. One such Lord of the Manor is the Lord Warden of the Cinque Ports (currently H.M. The Queen Mother), who has the right to Fishes Royal from the Naze (Essex) to a point near Newhaven (Sussex). However, it is always advisable to inform the Receiver of Wreck or The Natural History Museum (on the NHM stranding line 020 7942 5155) of the finding of a stranded cetacean.

In 1913 the Board of Trade and the British Museum (Natural History) set up a scheme for recording strandings of whales (including dolphins and porpoises). The stranded whale recording scheme is now part of an investigation supported since 1990 by the UK Department for Environment, Food and Rural Affairs and the Welsh Office into the biology and ecology of cetacean populations around the British Isles. This forms part of the UK Government's contribution to its response to ASCOBANS (the Agreement on the conservation of Small Cetaceans Of the Baltic And North Seas). The Institute of Zoology at The Zoological Society of London is heavily involved in this research, and has responsibility for co-ordinating investigations into the causes of death of cetaceans found around the coast of England and Wales. As a result of the post-mortem examinations carried out on these carcases additional investigations into the feeding habits, parasite burden and ages of these mammals can now be undertaken. These studies all contribute to the development of Biodiversity Action Plans (UK Biodiversity Group 1999).

Methods

It is important that we try to get information about every stranding as soon as possible so that we can draw scientifically meaningful conclusions. Live strandings should, of course, be reported to the RSPCA immediately (number in local phone book, or hotline 0870 5555 999), with a view to keeping the animal alive and returning it safely to the water if possible. It must be remembered that live animals may cause injury to humans by biting or, in some cases, by powerful blows from the tail. Keep clear of the tails of live-stranded whales, dolphins and porpoises at all times, and do not attempt to handle whales, dolphins, porpoises or seals without expert assistance and appropriate equipment (the RSPCA have instructions for dealing with this situation, and should be contacted immediately). A disease similar to brucellosis has been found in British cetaceans and we advise avoiding breathing in any spray from the animal's blow-hole.

As well as reporting strandings to The Natural History Museum and, if necessary, the RSPCA, members of the London Natural History Society will, of course, realize that their Mammal Recorder would be most interested to hear of any cetacean strandings or sightings in the area. Many publications are available with some cetacean identification information in them, but two useful books are Carwardine (1995) and Evans (1995).

If a fresh carcase is reported to us we do our best to arrange a post-mortem examination, taking the carcase to the Institute of Zoology. We may ask for the reporter to volunteer to drag the carcase above the High Water Mark (if the mud or sand is not so soft that there is a danger of sinking in it), but we always stress that Health and Safety precautions should be taken — we do not know why the animal died or how long it has been dead and decaying. If it is necessary to handle marine mammals, their carcases, or tissues from them, strict hygiene must always be observed. Transmission of disease from these animals to man can occur in several ways, for example through damaged skin, by breathing in droplets, or by fluids and tissues accidentally expelled from the carcase entering the mouth. Take care to avoid cuts, bites or scratches to your skin, and avoid touching such wounds on the stranded animal. A variety of bacterial and viral diseases can be transmitted through such skin wounds. **Wear strong rubber gloves and protective clothing when handling the animals or their tissues.** Always change out of protective clothing and wash thoroughly after handling marine mammals or their tissues. Inform your doctor if you become ill or develop localized infections after recent contact with marine mammals or their tissues. If it is necessary to transport carcases or tissues, these must be sealed securely in robust leak-proof packages.

After the post-mortem examination various samples are returned to The Natural History Museum for further study. Cetacean teeth have growth lines within them, which can be used by experts to age the animal. Any gut contents give valuable clues to the diet of the animal and sometimes an idea of where it has been recently (from what is known of the ecology and distribution of the prey items). Studying the parasite burden gives an idea of the state of health of the animal before it died, as well as increasing our knowledge of its parasites (e.g. Gibson et al. 1998).

Although a decayed carcase will not yield much information about health or feeding habits, it will still tell us something about the distribution of the different species and the age of the individual animals. We appreciate being informed about any stranding around the British Isles.

Cetacean stranding information is collated and entered into The Natural History Museum database, which is then used to produce distribution maps and information about trends for each species. These are presented as regular reports to DEFRA, and when suitable are published in the scientific press (e.g. Sheldrick et al. 1994). Since 1913, over 7,000 stranded cetaceans have been entered into this database, several species new to British waters have been recorded, and the collections and exhibitions at The Natural History Museum have been considerably enhanced.

Similarly, the data from all cetacean post-mortem examinations are entered into a database at the Institute of Zoology. Their staff produce reports and scientific papers on subjects such as cause of death (including diagnosis of live stranding in a cetacean later found dead), and correlations between contaminant levels and disease, reproductive or immunological status (e.g. Kuiken et al. 1994).

Strandings recorded from Greater London, 1913–2000

Many cetaceans have been recorded from the River Thames, a famous early example being the 58-foot long animal, possibly a right whale *Balaena glacialis*, found at Greenwich in 1658 (Fraser 1977). Another example (although not exactly a stranding) is the male killer whale *Orcinus orca*, 31 feet long, which 'was captured in the Thames on June 10, 1793, after an exciting chase, during which it towed a boat containing the harpooners twice from Blackwall to Greenwich and once to Deptford' (Harmer 1917). Fitter (1949) mentions two fin whales *Balaenoptera physalus*, seen between Albert Docks and Barking Creek on 27 November 1899.

It is probable that all animals as large as these would be recorded, but most cetaceans found upstream in the Thames would, of course, be much smaller. Harmer (1919, 1923, 1925) has notes on small cetaceans (reported as porpoises or dolphins, but not actually identified to species by an expert) being seen, presumably alive and swimming, at Richmond and Teddington on different occasions in 1917–1918, 1922 and 1923. Indeed, Fitter (1949) states 'Any small cetacean seen in the Thames — and at least one is seen almost annually — is usually reported as a porpoise'. A live bottle-nosed dolphin reached Richmond Bridge in October 1999, and was originally believed to have successfully returned to the North Sea (Anon. 1999). However, it may have been the female animal, length 3.2 m, which was found dead at Ramsgate in Kent on 15 November. Unfortunately, no photographs of the shape of the dorsal fin or other distinguishing features of the Richmond Bridge animal are available for comparison. Cetaceans will probably develop skin peeling due to long-term exposure to fresh water, but this will probably not be fatal (Jepson pers. comm.).

The cetacean deaths reported since the start of the recording scheme in 1913 from London, Middlesex, Surrey and those parts of Kent and Essex which are now in Greater London are listed here. The species, sex and length of the animal are given below, where known, but grid references are not given as sometimes locations were not reported very precisely (e.g. Millwall, Twickenham). The approximate locations are, however, mapped out in Figure 1.

Common dolphin *Delphinus delphis*

1.viii.1935	Putney Bridge, Surrey	M	2.41 m
1.iv.1937	Millwall, London	—	—
15.vii.1971	Twickenham, Middlesex	F	1.92 m
17.vii.1971	near Chiswick Bridge	F	1.92 m
22.v.1990	Lambeth Bridge, London	M	*c.* 1.83 m
23.v.1990	Landing Pier, Wapping, London	F	1.90 m

White-beaked dolphin *Lagenorhynchus albirostris*

2.ii.1965	Kings Reach (between London and Blackfriars Bridges), London	F	2.41 m

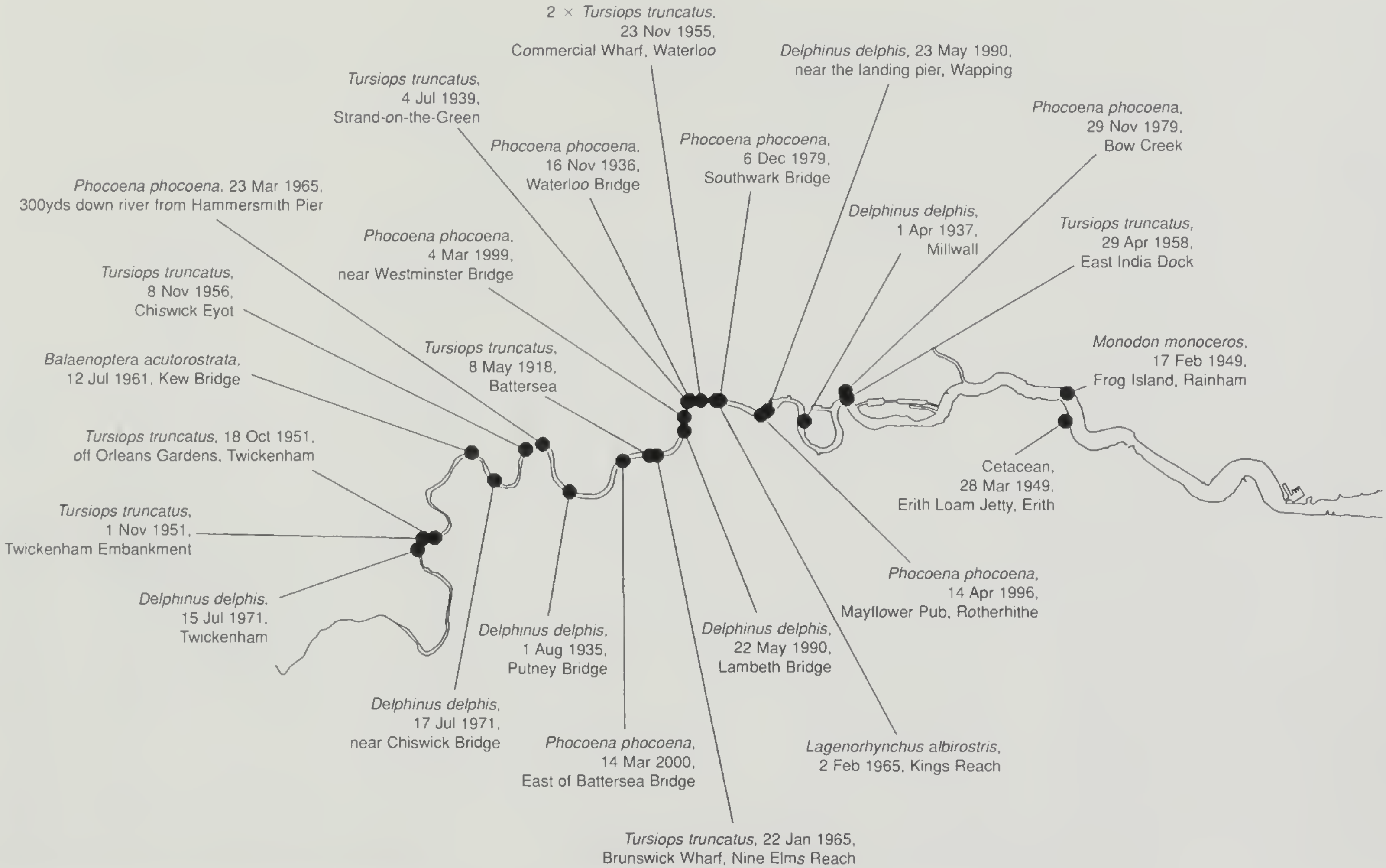
Phocoena phocoena, 23 Mar 1965, 300yds down river from Hammersmith Pier
Tursiops truncatus, 8 Nov 1956, Chiswick Eyot
Balaenoptera acutorostrata, 12 Jul 1961, Kew Bridge
Tursiops truncatus, 18 Oct 1951, off Orleans Gardens, Twickenham
Tursiops truncatus, 1 Nov 1951, Twickenham Embankment
Delphinus delphis, 15 Jul 1971, Twickenham
Tursiops truncatus, 4 Jul 1939, Strand-on-the-Green
Phocoena phocoena, 4 Mar 1999, near Westminster Bridge
Tursiops truncatus, 8 May 1918, Battersea
Delphinus delphis, 17 Jul 1971, near Chiswick Bridge
Phocoena phocoena, 16 Nov 1936, Waterloo Bridge
2 × Tursiops truncatus, 23 Nov 1955, Commercial Wharf, Waterloo
Delphinus delphis, 1 Aug 1935, Putney Bridge
Phocoena phocoena, 14 Mar 2000, East of Battersea Bridge
Tursiops truncatus, 22 Jan 1965, Brunswick Wharf, Nine Elms Reach
Phocoena phocoena, 6 Dec 1979, Southwark Bridge
Delphinus delphis, 22 May 1990, Lambeth Bridge
Delphinus delphis, 23 May 1990, near the landing pier, Wapping
Delphinus delphis, 1 Apr 1937, Millwall
Lagenorhynchus albirostris, 2 Feb 1965, Kings Reach
Phocoena phocoena, 14 Apr 1996, Mayflower Pub, Rotherhithe
Phocoena phocoena, 29 Nov 1979, Bow Creek
Tursiops truncatus, 29 Apr 1958, East India Dock
Monodon monoceros, 17 Feb 1949, Frog Island, Rainham
Cetacean, 28 Mar 1949, Erith Loam Jetty, Erith

FIGURE 1. The approximate locations of cetacean deaths in Greater London, 1913–2000.

Bottle-nosed dolphin *Tursiops truncatus*

8.v.1918	Drew-Bear, Perks and Co. wharf, Battersea, London	M	3.23 m
4.vii.1939	Strand-on-the-Green, London	M	3.14 m
4.vii.1939	Strand-on-the-Green, London	F	2.95 m
18.x.1951	Orleans Gardens, Twickenham, Middlesex	F	2.32 m
1.xi.1951	Twickenham Embankment, Twickenham, Middlesex	F	2.95 m
23.xi.1955	Commercial Wharf, Waterloo, London	—	3.35 m
8.xi.1956	Chiswick Eyot, Middlesex	F	2.92 m
29.iv.1958	East India Dock, London	—	2.03 m
22.i.1965	Brunswick Wharf, Nine Elms Reach, London	F	2.59 m

Harbour porpoise *Phocoena phocoena*

16.xi.1936	Waterloo Bridge, London	—	1.07 m
23.iii.1965	300 yards downriver from Hammersmith Pier, London	F	1.68 m
29.xi.1979	Bow Creek (junction of Rivers Lea and Thames), London	—	*c.* 1.37 m
6.xii.1979	Southwark Bridge, London	—	—
14.iv.1996	Mayflower Pub, Rotherhithe, London	M	1.07 m
4.iii.1999	County Hall/Westminster Bridge, London	F	1.43 m
14.iii.2000	South bank just downstream from Battersea Road Bridge, London	F	1.48 m

Narwhal *Monodon monoceros*

17.ii.1949	Frog Island, Rainham, Essex	F	3.94 m

Minke whale *Balaenoptera acutorostrata*

12.vii.1961	Kew Bridge, Surrey	F	4.65 m

Unidentified cetacean

28.iii.1949	Erith Loam Jetty, Erith, Kent	—	—

Some of the individual strandings of Royal Fish found in the Thames in Greater London are worthy of some comment, rather than the mere listing given above.

On 8 May 1918, a bottle-nosed dolphin *Tursiops truncatus*, male, length 3.23 m, stranded at Battersea. Johnson (1930, cited in Fitter 1949) says that it was seen to leap out of the river and catch two gulls. Harmer (1919) records that it 'had been seen swimming in the Thames in the early afternoon (summer time) of May 8, above and below Battersea Bridge, the tide being then high. At low water it was stranded on the mud close to the wharf of Messrs. Drew-Bear, Perks and Co., Ltd., by whose kind offices it was secured entire for the Museum . . .. A "large fish", doubtless the same individual, had been seen swimming in the river as far up as Hammersmith on May 7. The teeth . . . were worn almost down to the level of the gum, while those in the middle of the series had been completely lost . . .. These appearances indicate old age, and although the specimen was thus not a favourable one for testing the edible qualities of Cetacea, much of the flesh was eaten with satisfaction by many persons . . .'.

This was during the First World War, when there were food shortages in this country. The meat would probably not be eaten today on Health and Safety grounds (it was not definitely known what the animal died of), let alone the moral objections which could be raised, although there may have been such a case in Cornwall in recent times (Nicholson-Lord 1996). Fraser (1934) stated that 'It might be suggested that the Battersea specimen was a straggler remaining from the late months of the previous year'.

On 1 August 1935, a common dolphin *Delphinus delphis*, male, length 2.41 m, was found at Putney Bridge. Fraser (1946) records that 'The specimen . . . was one of a small school which was in the Thames for several days at the end of July and the beginning of August, and seen by Mr Hinton, Keeper of Zoology, and the writer, on August 1st in the neighbourhood of Vauxhall Bridge. The animal secured for the Museum had become entangled in mooring ropes, and was found drowned at Putney Bridge. The common dolphin does not generally frequent rivers as the common porpoise is known to do; the occurrence of a school in the Thames is, therefore, of some interest.'

On 4 July 1939, two bottle-nosed dolphins, a male, length 3.14 m, and a female, length 2.95 m, became stranded at Strand-on-the-Green. Fraser (1953) records 'Both animals were young; the testis length of the male was 10 cm.; the ovaries of the female, which were 5.1 cm. long, were quite immature and without trace of ripe follicles or corpora lutea.' Fraser (1974), writing of the six bottle-nosed dolphins stranded in the Thames from 1951 to 1965, said 'The East India Dock animal appeared to have been hit on the head and its side was damaged but the others were alive when first observed and that they stranded suggests an inability to evade the hazards of shoal waters or to escape to the open sea again'.

Early in the morning of 17 February 1949 a narwhal *Monodon monoceros* was found washed up on the bank of Frog Island, at Rainham in Essex. The carcase was reported as still warm when it was found, with several deep gashes on its head as though it had been hit by a propeller (Anon. 1949). The stranding was reported by Fraser (1949), and photographs were published by Fraser (1974). This is one of the only two narwhal strandings recorded in Great Britain since 1808, the other one being at Wouldham on the River Medway in north Kent on 9 July 1949. As Fraser (1974) says, 'The relative proximity of time and place might suggest that the two animals were together until the stranding of the first of them at Rainham . . .'. The Rainham carcase sank while being towed back into the river. The unidentified cetacean washed up at Erith five and a half weeks later may have been the same animal, but unfortunately The Natural History Museum has no details of this latter stranding.

On 2 February 1965 a white-beaked dolphin *Lagenorhynchus albirostris*, female, length 2.41 m, was found at King's Reach (between London and Blackfriars Bridges), London. This is apparently a first record for the River Thames, although the species is known to live in the northern and central North Sea (Evans 1987) and is commonly found stranded on the North Sea coasts of England and Scotland.

In July 1971, two common dolphins were seen swimming in the Thames for about a fortnight before one was found dead near Twickenham. The other was caught alive near Chiswick Bridge by a team from the London Dolphinarium two days later but died after an hour. Both were females, 1.92 m long, although the second was said to be 'probably too young to catch fish and feed himself' (Anon. 1971). In May 1990, two more common dolphins (a male about 1.83 m long and a female 1.90 m long) died despite rescue attempts involving the RSPCA and the police (Anon. 1990*c*) after spending about a fortnight swimming in the Thames. These dolphins were reported in at least three national newspapers (Macdiarmid 1990, Newland 1990, Shrimsley and Fenton 1990, Thompson 1990). The carcases were autopsied at Windsor Safari Park (Anon. 1990*a*,*b*), and the Thames water quality was called into question (Davies 1990). The male has been aged from its teeth at eleven years.

The porpoise *Phocoena phocoena* found at Rotherhithe in April 1996 (a male, 1.07 m long) died due to physical trauma (probably having been hit by the propeller of a boat). The porpoise found near County Hall in March 1999 (female, 1.43 m long) was a live stranding, and on post-mortem examination was found to have been pregnant and also heavily parasitized. Another porpoise (female, 1.48 m long), found in March 2000 on the South Bank just downstream from Battersea Road Bridge, died due to a heavy lungworm infection.

Discussion

More cetaceans have, of course, been recorded from the Thames Estuary along the shores of Essex and Kent, which are more open to the southern North Sea. A recent example is the minke whale *Balaenoptera acutorostrata* calf which stranded alive, but subsequently died, at Purfleet, Essex on 29 October 1996. Paul Jepson of the Institute of Zoology, with the help of staff from The Natural History Museum, was able to give this animal a post-mortem examination on the shore (the cause of death was starvation).

The frequency of stranding of the individual species in the Thames does not exactly reflect their frequencies on the coastlines of England and Wales, as shown in the following table:

	Greater London		**England and Wales**	
	Rank	**Number**	**Rank**	**Number**
Bottle-nosed dolphin	1	9	6	242
Harbour porpoise	2	7	1	1,857
Common dolphin	3	6	2	653
White-beaked dolphin	=4	1	8	191
Narwhal	=4	1	27	2
Minke whale	=4	1	9	97
Unidentified cetacean	=4	1	5	279

For instance, the bottle-nosed dolphin is not the most common species nationally. It is, like all the dolphins, a powerful swimmer, and individuals can be found far from their resident populations in the Moray Firth, Cardigan Bay and the English Channel (Muir, in prep.). It is also apparently sometimes not averse to human company (Lockyer 1990). The harbour porpoise, on the other hand, is the most common cetacean around our shores, and as its common name implies it is often seen in harbours and estuaries. It must be remembered, however, that these are wild animals and quite likely to become distressed if approached. The Department for Environment, Food and Rural Affairs has issued guidelines about interactions between humans and cetaceans — basically it is best to watch live animals from a distance.

The common dolphin is more often found on British shores which are open to the Atlantic Ocean, unlike the white-beaked dolphin which, as stated above, is known to live in the northern and central North Sea. The narwhal has been seen swimming off Scottish shores in recent years, but strandings are very rare in UK waters. The minke is the smallest of the baleen whales and it is thought that numbers in the Atlantic might have recovered to a certain extent after whaling activities decreased (unlike the Greenland right whale situation, Klinowska 1991). However, the Norwegian whaling activities are ongoing (Grøvnik 1998), which might affect the numbers seen near our shores.

The common dolphin was only found stranded in Greater London in the warmer months, as opposed to the bottle-nosed dolphin, which was found throughout the year. Other than this, little can be said about the peak months for strandings because of the low numbers involved.

The ASCOBANS treaty is designed to lead to the conservation of small cetaceans in the North Sea, so it may be expected that dolphins and porpoises will continue to be seen in the Thames in Greater London. Several of these animals have been seen upstream since the building of the Thames Barrier (1974–1984) between Silvertown and New Charlton, but this is likely to be a deterrent to larger whales. It is considered highly unlikely that very large deep-water species such as the sperm whale *Physeter macrocephalus* will be found in Greater London, although they are occasionally seen in the southern North Sea (Jacques and Lambertsen 1997, Muir 1999).

Acknowledgements

This project could not have succeeded without the help of the many people and organizations who have reported strandings over the years. The Museum has been supported in this work by the UK Department for Environment, Food and Rural Affairs and the Welsh Office since 1990. The author is grateful to Mr Paul Jepson, of the Institute of Zoology, for information from the post-mortem examinations he has carried out, and to Mr James Chimonides, of the NHM, for setting up the computer database and mapping procedures.

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Book review

The birdwatcher's handbook: a guide to the birds of Britain and Ireland. Jonathan Elphick. BBC Worldwide Ltd, London. 2001. 320 pp. £14.99 softback. ISBN 0 563 53416 8.

This is a revised edition of a field guide originally published as *Birds: a guide book to British birds* in 1997 to accompany a BBC video guide to British birds. The book and video were originally sold together, though the book was also available separately. In the revised edition, all cross-references to the video have been removed.

The book's 'exclusive focus' on the birds of Britain and Ireland is — despite the publisher's claims — by no means unique but does at least avoid confusing beginners by including birds rarely or never being seen here, such as crested lark, which appear in too many such guides. The text for each species is helpful, pointing out key points of identification. For those accorded full treatment, a shaded box covers 'key facts' including length, wingspan, weight, habitat, movements, population, diet, voice, maturity and confusion species; and, for breeding species, nest, eggs, incubation, fledging and broods. Thus, for most species, the text covers much more than just field identification, going some way to justifying the book's *Handbook* title. However, the coverage is variable. Some species — including a number which occasionally breed — such as spoonbill, little egret, ring-necked duck, yellow-legged gull and golden oriole, which are more likely to be encountered than others covered in detail (e.g. greenish and Arctic warblers), are only barely covered. Ring-billed gull is, however, given the full (one page) treatment. Other species are deemed worthy of coverage over two pages, but rarely on account of the identification problems they pose (e.g. gannet, peregrine, red grouse, woodcock, puffin, swallow, wheatear and long-tailed tit).

The identification texts are reliable, as would be expected in a book for which Rob Hume was consultant. The 'key data' are also generally to be trusted, but — since it is now a characteristic member of the London avifauna — it is worth noting that the stated population of ring-necked (or rose-ringed) parakeet — up to 5,000 individuals — is on the high side (since a census of all communal roosts in 1996 estimated the total population at only 1,500 individuals). The book's introductory material, which runs to thirty-eight pages, is admirably clear and comprehensive. It covers not only advice on how to identify birds but also includes a guide to bird habitats. It adds over a tenth to the book's length, but is still remains small enough and, at 475 g, light enough to be taken into the field in a jacket pocket.

The illustrations typically encompass all a species' plumages and include the birds in flight as well as on land/water. Jonathan Elphick — a resident of north London — has employed as many as eight artists to provide the artwork, including such household names as Robert Gillmor, Peter Hayman and Martin Woodcock. Nearly a third of the field guide pages have paintings by Peter Hayman while less-well-known artist Owen Williams was responsible for nearly a quarter. The use of illustrations by a number of artists results in a variety of styles, some of which look better than others. Richard Allen's passerines are particularly pleasing to my eye, while Peter Hayman has, surprisingly given his experience as a field guide illustrator, not correctly shown the characteristic and distinctive head pattern of female (common) pheasant (i.e. the black-bordered white crescent under and behind the eye). The bill on his female yellow wagtail has been truncated, which could mislead beginners, though that looks more like a printing error.

In conclusion, despite the few flaws noted above, I agree with the assessment of another reviewer that 'this is still the best and most practical beginner's guide to British and Irish birds' (Mark Cocker writing in *British Birds* in September 2001). It would make an excellent Christmas present for a newcomer to birdwatching.

MIKE EARP

Trapping surveys of small mammals on Wimbledon Common, Bushy Park and Ham Lands, south-west London

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Abstract 109
Introduction 109
Study areas 111
Methods 112
Results 114
Discussion 117
Acknowledgements 120
References 121
Appendix — Site descriptions 122
Postscript 125

Abstract

This paper presents the results of live-trapping studies of shrews, mice and voles in three south-west London study areas: Wimbledon Common (October 1996), Bushy Park (October 1997) and Ham Lands (October 1997). Species records and relative abundance estimates (trap-night index) were compared between these areas and with a reanalysis of a survey of Richmond Park (23 September–2 October 1994). The number of small mammal species varied between areas; five in Richmond Park, four from Bushy Park and Wimbledon Common, and two on Ham Lands. The species were: wood mouse *Apodemus sylvaticus*, field vole *Microtus agrestis*, bank vole *Clethrionomys glareolus*, common shrew *Sorex araneus*, and only in Richmond Park, pygmy shrew *Sorex minutus*. Wood mice and bank voles were found in all study areas. Species richness (Log-series alpha index) was comparatively high in Richmond and Bushy Parks despite low overall abundance. Wood mice dominated numerically in all areas except Bushy Park. Reciprocal Simpson's index values indicated that Wimbledon Common and Richmond Park had the greatest species-diversity and Ham Lands the least. There was considerable variation in species and abundance between trapping sites within each study area: beta-diversity (Whittaker's index) was greatest in Richmond Park but progressively less marked (respectively) in Bushy Park, Wimbledon Common and Ham Lands. The Morisita-Horn index of similarity found the small mammal communities of Wimbledon Common and Richmond Park to be the most similar. Ham Lands showed equal similarity with Wimbledon Common and Richmond Park, but Bushy Park showed low similarity with all the other sites. Although methodological issues and habitat differences are important to consider, it is hypothesized that the differences observed may be partly explained by varying levels of habitat fragmentation and isolation both within and between study areas.

Introduction

Following the small mammal survey of Richmond Park in October 1994 (Reeve and Jones 1996) we conducted further surveys of three other areas in south-west London: Wimbledon Common (October 1996), Bushy Park (October 1997) and Ham Lands (October 1997) (Figure 1). These areas have considerable wildlife value, but there have been no systematic trapping surveys of terrestrial small mammals (mice, voles and shrews) although there are a few published records for Wimbledon Common and Bushy Park.

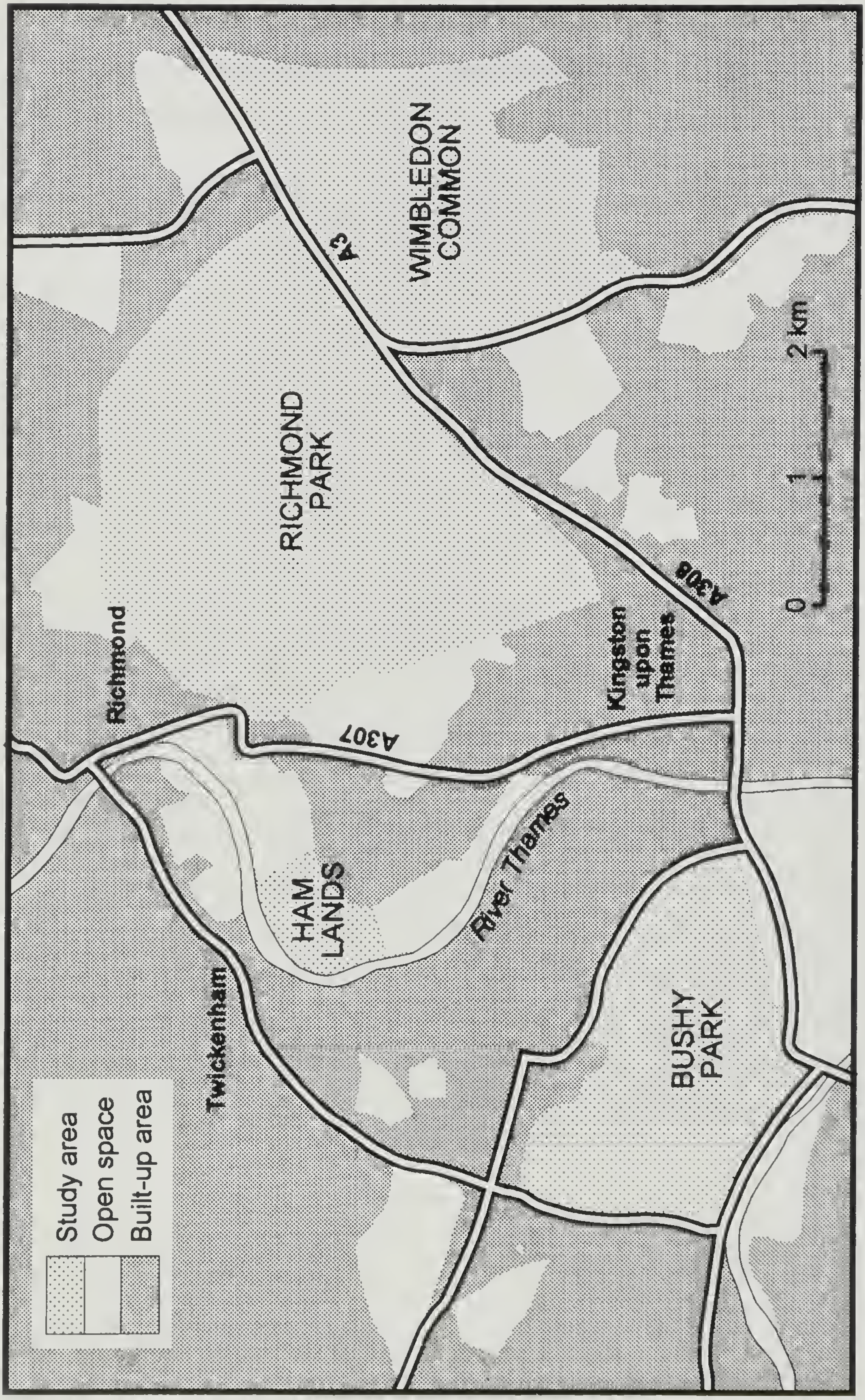

FIGURE 1. Map showing the locations of the study areas.

The present study aimed to survey these previously unexamined areas, so as to provide up-to-date species records and relative abundance estimates for each species and habitat sampled in a way comparable with the previous Richmond Park survey. The trap night index (TNI), an index of catch per unit effort expressed as the number of captures per 100 trap-'nights' (24-hour periods), is a simple expression of relative abundance which was used in the Richmond Park survey (Reeve and Jones 1996) and a number of previous studies (e.g. Singleton 1989, Delany and Farook 1989, Yalden and Shore 1991, Gurnell et al. 1992). Its reliability may be questionable (Tanaka 1960) but longer-term studies using absolute population estimation methods could not be resourced. The aim was to make the best use of limited time and resources to survey between three and four different sites per study area so that a representative range of small mammal habitats would be sampled within each area.

Nomenclature follows Corbet and Harris (1991).

Study areas

1. Wimbledon Common

Wimbledon and Putney Commons encompass 461 hectares, 364 hectares of which were designated in 1986 as a Site of Special Scientific Interest (SSSI). The principal habitats are secondary broadleaved woodland (about 182 hectares) plus 170 hectares of heathland, scrub and acid grassland (comprised of coarse grassland, amenity areas and recreational grounds). Additional habitats include a bog, eight ponds, a minor river (Beverley Brook) and several kilometres of unfenced perimeter verges (Nature Conservancy Council 1969). Published small mammal records are: common shrew *Sorex araneus* (Hall 1978), pygmy shrew *Sorex minutus* (Fitter 1949), water shrew *Neomys fodiens* (Beames 1968), wood mouse *Apodemus sylvaticus* (Fitter 1949, Cotton 1979), bank voles *Clethrionomys glareolus* near Beverley Brook (Teagle 1963).

In the present study, four trapping sites were selected (for site details see Appendix 1.1). Site WC1, Heath: an open area of heath with surrounding wooded areas. Site WC2: The Clockhouse, an area of open partially cleared deciduous woodland and scrub with bracken and grass. Site WC3: The Plain, an area of unmown long grass. Site WC4: Cassels Chasm, a valley of dense deciduous woodland. None of these trapping sites was considered suitable habitat for water shrews and no catch of this species was expected.

2. Bushy Park

An enclosed Royal Deer Park of 450 hectares. It consists of large areas of deer-grazed acid grassland with scattered mature trees, recreation areas and a number of fenced woodland plantations which vary in size but include a 13-hectare area of woodland gardens accessible to the public. About 320 red and fallow deer *Cervus elaphus* and *Dama dama* are maintained in the Park. West of the Longford River lie the Brewhouse Fields; cultivated grasslands bordered by hedgerows from which both deer and the public are excluded. Published small mammal records are: common shrew (Beames 1969) pygmy shrew and field vole (Teagle 1965).

In the present study, three trapping sites from which the public were excluded were selected for sampling (for site details see Appendix 1.2). Site BP1: Canal Plantation (bisected by a narrow lake), about three hectares of enclosed oak/alder woodland with a closed canopy and generally low, rather open understory dominated by bramble. Site BP2: Round Plantation, about 1.5 hectares of enclosed mixed deciduous woodland. Site BP3: Brewhouse Meadow, a field of ungrazed improved rough grassland uncut for three years.

3. Ham Lands

Ham Lands, a 73-hectare area of in-filled gravel workings, was designated as a Local Nature Reserve in 1992.The site is bisected by a water sports lagoon, the Thames Young Mariners base, owned by Surrey County Council. The northern part of the Ham Lands area is retained as open wash land to accommodate flood water from the adjacent River Thames. The grounds around Ham House, Petersham Lodge Wood and Petersham Meadows extend in an almost continuous strip, along the bank of the Thames, from Ham Lands towards Richmond.

Three trapping sites in the Ham Lands area were selected (for site details see Appendix 1.3). Site HL1: Water Meadow, the edge of a densely wooded hedgerow running along a river bank bordering a roughly mown flood-meadow. Site HL2: Thames Young Mariners, the trap line ran along the border of a mown lawn and a vegetated (shrubs, trees and longer grass) steep bank sloping down to an artificial water sports lagoon. Site HL3: Reed Bed, traps were placed on the boundary of an area of reeds and rough scrub-invaded grassland. All three trapping sites were sampling edge habitats. We have been unable to find any small mammal records for Ham Lands.

4. Richmond Park

An enclosed Royal Deer Park of 955 hectares, designated an SSSI in 1992 and a National Nature Reserve in May 2000. It also has several adjacent areas (Sudbrook Park Golf Course and the commons of Petersham, Palewell, Ham and East Sheen) to form a total area of 1,060 hectares (Archer and Curson 1993). Most of the park (over two-thirds) is covered by large open areas of semi-natural grassland and bracken on acidic nutrient-poor soils with scattered mature trees. About 218 hectares is woodland and there are 15.7 hectares of ponds and lakes. About 700 red and fallow deer are maintained in the Park. The public have unrestricted access to almost the entire area but there are 70 hectares of fenced plantations and other areas from which the public are excluded (LUC 1984).

Seven trapping sites were selected (for details see Appendix 1.4) which can be grouped into three main habitat types with roughly equal trapping effort:

i Mixed deciduous woodland plantations with no access to deer or the public. Sites: RPB (Bog Dump Plantation), RPC (Teck Plantation) and RPG (Sidmouth Wood).

ii Acid tussock grassland, uncut. Sites: RPA (Conduit Stream) and site RPE (Pond Slade).

iii Improved grassland cut annually: Sites: RPD (The Flying Field) and RPF (Adam's Pond).

Reeve and Jones (1996) reviewed the published records of shrews, mice and voles in Richmond Park which included seven species likely to be caught in Longworth traps: common shrew, pygmy shrew, water shrew, wood mouse, house mouse *Mus domesticus*, bank vole and field vole *Microtus agrestis*. All these species were recorded in the 1994 survey except water shrew and house mouse for which none of the trapping sites was considered suitable habitat.

Methods

All surveys were conducted in autumn when populations are normally at a post-breeding peak (Alibhai and Gipps 1985, Flowerdew 1985, Gurnell 1985). See Table 1 for summary study details. The trapping period was 72 hours except on Ham Lands where the study was ended at 36 hours when the onset of cold and very wet weather threatened to compromise the welfare of the study animals. Longworth traps plus fifteen Anderson traps were used and the trapping and handling of animals was conducted according to the guidelines in Gurnell and Flowerdew (1990). Trap-lines were used to survey the species present in as wide a range of habitats as possible within the time and resources available. Typically, three traps were sited at stations spaced approximately ten metres apart, but the spacing was varied as necessary to ensure that traps could be appropriately located and concealed. Traps were baited with mixed grain, blowfly pupae (for shrews) and dry hay bedding was provided. No pre-baiting period was used. Traps were checked three times daily. Captured animals were sexed and weighed using a 50-gram spring balance (Salter), their age was estimated then each was individually marked by fur clipping (Gurnell and Flowerdew 1990) or with coloured permanent marker pens, before release at the capture point. All volunteers received appropriate training and one or more experienced worker was always present.

TABLE 1. Summary details for the previous Richmond Park study (Reeve and Jones 1996) and the three new trapping studies.

	Richmond Park		**Wimbledon Common**	**Bushy Park**	**Ham Lands**
	1994	**1994**	**1996**	**1997**	**1997**
Study dates	23–25 Sept.	30 Sept.–2 Oct.	3–6 Oct.	2–5 Oct.	29–31 Oct.
Study duration	72 h	72 h	72 h	72 h	36 h
No. trapping sites	3	4	3	3	3
Total no. traps	90	150	143	60	60

The relative abundance of species was expressed as an index of catch per unit effort i.e. the number of captures per 100 trap-'nights' (24-hour periods). However, when traps are closed by captures and accidental triggers (e.g. disturbance by dogs, or when slugs enter the trap) the resultant loss of trapping effort can distort such indices (Nelson and Clark 1973). It is unknown precisely how long any trap may have been closed, so for every closed trap approximately half the maximum period between setting and checking traps was deducted from the total trapping effort; seven hours in the morning and two hours for the noon and evening trap checks. The TNI figures from Reeve and Jones (1996) were recalculated from the original raw data in the same way.

Species diversity indices were selected on the basis of a number of criteria, as discussed in Southwood (1978) and Magurran (1988). Reliable fitting of the data to particular species-abundance models was impractical with between two and five species per site. The log series alpha (α) was used as an expression of species richness because of its good discriminant ability and relative independence from the effects of sample size. Dominance (unevenness in species abundance) was expressed using the Berger-Parker index (BP) for each trapping site and jack-knifed reciprocal Simpson's index (1/D) for study areas. Whittaker's ß diversity index (ß$_w$) was used to express the differences in the species composition between the trapping sites within each study area. The Morisita-Horn index of similarity (C_{MH}) was used to compare sites because of its relative insensitivity to species richness and sample size, which are both low in this study. Calculations were carried out using numbers of individuals caught and according to the procedures in Magurran (1988) and using the software package Bio-DAP*.

* Bio-DAP software by Gordon Thomas & Douglas Clay (1996) of Parks Canada (PHQ) and Fundy National Park, Canada.

Results

For the number of captures and TNI values for each species, trapping site and study area in the present study see Tables 2–4. Table 5 shows the recalculated results of the previously published Richmond Park survey (Reeve and Jones 1996). The total catches of each species from all four areas are summarized in Table 6 and a summary of the abundance and diversity statistics are presented in Table 7.

TABLE 2. The numbers of individuals, total catch (includes recaptures) and TNI* for species in each of four trapping sites on Wimbledon Common (October 1996).

Habitat/Site	**Species**	**Trap-nights**	**No. of individuals**	**Total catch**	**TNI (individuals)**	**TNI (total catch)**
Heathland (Site WC1)	*A. sylvaticus*	110.21	7	17	6.35	15.43
	S. araneus	110.21	1	1	0.91	0.91
	All species	**110.21**	**8**	**18**	**7.26**	**16.33**
Open canopy woodland (Site WC2)	*A. sylvaticus*	84.04	13	21	15.47	24.99
	C. glareolus	84.04	1	1	1.19	1.19
	S. araneus	84.04	1	1	1.19	1.19
	All species	**84.04**	**15**	**23**	**17.85**	**27.37**
Grassland (Site WC3)	*A. sylvaticus*	104.75	57	106	54.42	101.19
	C. glareolus	104.75	3	3	2.86	2.86
	M. agrestis	104.75	30	47	28.64	44.87
	S. araneus	104.75	7	7	6.68	6.68
	All species	**104.75**	**97**	**163**	**92.60**	**155.61**
Closed canopy woodland (Sites WC4)	*A. sylvaticus*	68.29	27	77	39.54	112.75
	C. glareolus	68.29	9	22	13.18	32.21
	S. araneus	68.29	1	4	1.46	5.86
	All species	**68.29**	**37**	**103**	**54.18**	**150.82**

TABLE 3. The numbers of individuals, total catch (includes recaptures) and TNI* for species in each of three trapping sites in Bushy Park.

Habitat/Site	**Species**	**Trap-nights**	**No. of individuals**	**Total catch**	**TNI (individuals)**	**TNI (total catch)**
Canal plantation (Site BP1)	*C. glareolus*	89.63	2	2	2.23	2.23
	M. agrestis	89.63	2	3	2.23	3.35
	S. araneus	89.63	1	5	1.12	5.58
	All species	**89.63**	**5**	**10**	**5.58**	**11.16**
Round plantation (Site BP2)	*C. glareolus*	88.13	1	1	1.13	1.13
	All species	**88.13**	**1**	**1**	**1.13**	**1.13**
Brewhouse meadow (Site BP3)	*A. sylvaticus*	86.00	1	1	1.16	1.16
	C. glareolus	86.00	11	17	12.79	19.77
	M. agrestis	86.00	3	3	3.49	3.49
	S. araneus	86.00	1	1	1.16	1.16
	All species	**86.00**	**16**	**22**	**16.67**	**23.33**

*TNI (Trap-Night Index) = number per 100 trap-nights

TABLE 4. The numbers of individuals, total catch (includes recaptures) and TNI* for species in each of three trapping sites in Ham Lands.

Habitat/Site	Species	Trap-nights	No. of individuals	Total catch	TNI (individuals)	TNI (total catch)
Water meadow (Site HL1)	*A. sylvaticus*	21.83	26	30	119.10	137.43
	C. glareolus	21.83	1	1	4.58	4.58
	All species	**21.83**	**27**	**31**	**123.68**	**142.01**
T.Y.Mariners (Site HL2)	*A. sylvaticus*	28.67	5	5	17.44	17.44
	C. glareolus	28.67	1	1	3.49	3.49
	All species	**28.67**	**6**	**6**	**20.93**	**20.93**
Reedbed (Site HL3)	*A. sylvaticus*	26.50	14	15	52.83	1.16
	C. glareolus	26.50	0	0	0.00	0.00
	All species	**26.50**	**14**	**15**	**52.83**	**56.60**

TABLE 5. The numbers of individuals, total catch (includes recaptures) and TNI* for species in each of seven trapping sites) in Richmond Park. Data recalculated from raw data used by Reeve and Jones (1996). Woodlands were all fenced plantations of mixed deciduous species.

Habitat/Site	Species	Trap-nights	No. of individuals	Total catch	TNI (individuals)	TNI (total catch)
A: acid grassland	*A. sylvaticus*	117.58	3	4	2.55	3.40
	C. glareolus	117.58	3	5	2.55	4.25
	S. minutus	117.58	1	1	0.85	0.85
	All species	**117.58**	**7**	**10**	**5.95**	**8.50**
B: woodland	*A. sylvaticus*	56.42	9	11	15.95	19.50
	S. araneus	56.42	1	1	1.77	1.77
	All species	**56.42**	**10**	**12**	**17.72**	**21.27**
C: woodland	*A. sylvaticus*	56.21	11	12	19.57	21.35
D: improved grassland	*C. glareolus*	119.54	2	3	1.67	2.51
E: acid grassland	*M. agrestis*	58.50	4	5	6.84	8.55
	S. araneus	58.50	3	3	5.13	5.13
	All species	58.50	**7**	**8**	**11.97**	**13.68**
F: improved grassland	*M. agrestis*	59.29	3	3	5.06	5.06
G: woodland	*A. sylvaticus*	57.38	5	5	8.71	8.71
	C. glareolus	57.38	3	3	5.23	5.23
	S. araneus	57.38	1	1	1.74	1.74
	All species	57.38	**9**	**9**	**15.68**	**15.68**

*TNI (Trap-Night Index) = number per 100 trap-nights

TABLE 6. The total numbers of individuals, total catch (includes recaptures) and TNI* for each species for each of the four study areas.

Study area/Site	**Species**	**Trap-nights**	**No. of individuals**	**Total catch**	**TNI (individuals)**	**TNI (total catch)**
Wimbledon Common (all sites)	*A. sylvaticus*	367.29	104	221	28.32	60.17
	C. glareolus	367.29	13	26	3.54	7.08
	M. agrestis	367.29	30	47	8.17	12.8
	S. araneus	367.29	10	13	2.72	3.54
	All species	**367.29**	**157**	**307**	**42.75**	**83.58**
Bushy Park (all sites)	*A. sylvaticus*	263.75	1	1	0.38	0.38
	C. glareolus	263.75	14	20	5.31	7.58
	M. agrestis	263.75	5	6	1.90	2.27
	S. araneus	263.75	2	6	0.76	2.27
	All species	**263.75**	**22**	**33**	**8.34**	**12.51**
Ham Lands (all sites)	*A. sylvaticus*	77.00	45	50	58.44	64.94
	C. glareolus	77.00	2	2	2.60	2.60
	All species	**77.00**	**47**	**52**	**61.04**	**67.53**
Richmond Park (all sites)	*A. sylvaticus*	524.91	28	32	5.33	6.10
	C. glareolus	524.91	8	11	1.52	2.10
	M. agrestis	524.91	7	8	1.33	1.52
	S. araneus	524.91	5	5	0.95	0.95
	S. minutus	524.91	1	1	0.19	0.19
	All species	**524.91**	**49**	**57**	**9.33**	**10.86**
All sites	**All species**	**1,232.95**	**275**	**449**	**22.30**	**36.42**

*TNI (Trap-Night Index) = number per 100 trap-nights

TABLE 7. Species richness, relative abundance and species dominance of the study sites. Overall abundance is indicated by the TNI for individuals of all species. BP=The Berger Parker Dominance Index. Reciprocal Simpson's index (1/D) was obtained after jack-knifing (Magurran 1988). *A.s = Apodemus sylvaticus*, *C.g. = Clethrionomys glareolus*, *M.a. = Microtus agrestis.*

Study area/Site	**No. Species**	**TNI**	**BP index**	**Dominant species**	**Log series α**	**1/D**
Wimbledon Common						
WC1: Heath	2	7.26	0.88	*A.s.*	0.86	
WC2: Open woodland	3	17.85	0.87	*A.s.*	1.13	
WC3: Uncut grassland & scrub	4	92.60	0.59	*A.s.*	0.84	
WC4: Closed-canopy woodland	3	54.18	0.73	*A.s.*	0.77	
Whole study area	4	42.75	0.66	*A.s.*	0.75	2.32
Bushy Park						
BP1: Woodland plantation	3	5.58	0.40	*C.g./M.a.*	3.17	
BP2: Woodland plantation	1	1.13	1.00	*C.g.*	-.-*	
BP3: Improved grassland (uncut)	4	16.67	0.69	*C.g.*	1.71	
Whole study area	4	**8.34**	**0.64**	***C.g.***	**1.43**	1.41

Ham Lands						
HL1: Hedgerow/cut meadow	2	123.68	0.96	*A.s.*	0.50	
HL2: Border of shrubs/lawn	2	20.93	0.83	*A.s.*	1.05	
HL3: Reedbed/grassland+scrub	1	52.83	1.00	*A.s.*	0.25	
Whole study area	**2**	**67.53**	**0.96**	***A.s.***	**0.42**	**1.08**
Richmond Park						
RPA: Acid grassland	3	5.95	0.43	*C.g./A.s.*	1.99	
RPB: Woodland plantation	2	17.72	0.90	*A.s.*	0.75	
RPC: Woodland plantation	1	19.57	1.00	*A.s.*	0.27	
RPD: Improved grass (cut/grazed)	1	1.67	1.00	*C.g.*	0.80	
RPE: Acid grassland	2	11.97	0.57	*M.a.*	0.94	
RPF: Improved grass (cut/grazed)	1	5.06	1.00	*M.a.*	0.53	
RPG: Woodland plantation	3	15.68	0.56	*A.s.*	1.58	
Whole study area	**5**	**9.33**	**0.57**	***A.s.***	**1.39**	**2.38**
All 4 study areas combined	**5**	**22.30**	**0.65**	***A.s.***		

*single capture gives an invalid value

The number of small mammal species found in each study area was quite variable; five in Richmond Park, four in Bushy Park and Wimbledon Common, and only two on Ham Lands. The comparatively high species richness (α) values for Richmond and Bushy Parks reflect the relatively large number of species found despite the low catch in these areas. The reciprocal Simpson's index values (1/D) suggest that Wimbledon Common and Richmond Park were the most diverse when species dominance is also considered. Both α and 1/D values agree that Ham Lands is the least diverse and the high Berger-Parker index value (0.96) expresses the strong dominance of wood mice in the catch of all three Ham Lands sites. Wood mice were also dominant in the catch from all four sites on Wimbledon Common, but were less consistently dominant in Richmond Park. Despite their dominance in the other three study areas, wood mice were almost absent (a single capture) in Bushy Park.

Beta-diversity (Whittaker's index, $ß_w$) was by far the greatest in Richmond Park ($ß_w$ = 1.69) where seven areas falling into three main habitat types (plantation woodland, acid grassland, improved cut grassland) were sampled with varying results. In Bushy Park ($ß_w$ = 0.50) only the uncut improved grassland yielded good catches. The woodland plantations differed markedly with much lower abundances and fewer species. On Wimbledon Common ($ß_w$ = 0.33) catches were somewhat more even between the sites, but the heathland was relatively species-poor with lower abundance. All sites on Ham Lands ($ß_w$ = 0.20) had only one or two species.

The Morisita-Horn index of similarity allowed an overall comparison of the small mammal communities of the four study areas. Wimbledon Common and Richmond Park were the most similar (C_{MH} = 0.978). Ham Lands showed equal similarity with Wimbledon Common and Richmond Park (C_{MH} = 0.850), but Bushy Park showed low similarity with all the other sites (C_{MH} values in the range 0.102 to 0.403).

Discussion

Differences between the study areas in relative abundance and species composition are not easy to account for because of the many factors that may influence these variables. Some of the differences may have been due to chance inclusion/exclusion in the sample of species occurring at low densities. For example, pygmy shrews generally occur at lower densities than common shrews (Trump 1989) and their low bodyweight causes under-sampling by Longworth trapping (Gurnell and Flowerdew 1990). The 1994 Richmond Park survey caught only one pygmy shrew and with such low catch rates it is unsafe to assert that they are now absent from both Wimbledon Common and Bushy Park where they have previously been recorded, albeit some decades ago (Fitter 1949, Teagle 1965). Field voles have also been noted to be reluctant to enter live traps (Redpath et al. 1995) and therefore may not be detected at low densities.

Bank voles (herbivorous) and wood mice (herbivorous/omnivorous), although typical of deciduous woodland with good ground cover, are able to exploit hedgerows and a wide range of habitat types (Montgomery and Bell 1981, Gurnell 1985, Flowerdew 1985, Alibhai and Gipps 1991*a*, Gorman and Zubaid 1993). It is therefore no surprise to have found both in all four study areas. Common shrews (insectivorous) can also exploit a variety of habitats (Churchfield 1991) and, like the field vole (herbivorous grassland specialist), were found in all study areas except Ham Lands.

The comparatively short study at Ham Lands may have caused an under-estimate of the number of species present, although catch rates were extremely high, totalling forty-five wood mice and two bank voles. The extreme dominance of wood mice on this site is interesting although it may partially be an artefact of the wood mice filling traps and effectively excluding other species. Nevertheless, despite the fact that Ham Lands is adjacent to the grounds around Ham House and thence to Petersham Lodge Woods and Petersham Meadows (all bordering the Thames) it is relatively isolated. The River Thames creates an almost absolute barrier to the north, south and west. To the east there is dense housing and a busy road (A307) which, although punctuated by school playing fields, is poor habitat with a dense population of domestic cats as well as natural predators. This would limit small mammal exchange with nearby Ham Common, Sudbrook Park Golf Course and Richmond Park. The towpath may also provide some limited opportunities for small mammal dispersal but it traverses areas of tarmac, non-native species (e.g. Himalayan balsam *Impatiens glandulifera*), dog-fouled neutral grassland and rubbish-filled ditches. Therefore, although isolation is not complete, barriers to immigration may have resulted in gradual loss of species following stochastic population events (e.g. floods, bad weather). Both common and pygmy shrews are comparatively sedentary, the largest ranges reported by Churchfield (1991) were 0.11 hectares and 0.17 hectares respectively. For field voles, which tend to specialize in rough ungrazed grassland, the largest home range reported by Alibhai and Gipps (1991*b*) was 0.06 hectares. However, all such figures represent the ranges of established individuals and dispersal distances could be much longer, especially in fragmented habitats (Peles et al. 1999). Nevertheless, the species most likely to be able to rebuild and thus maintain its population in the area would be the wood mouse. Wood mice readily move through open land, make frequent excursions outside their home ranges (Wolton 1985) and do not depend upon hedgerows as corridors. They may travel distances exceeding 1,000 metres (Peles et al. 1999), especially on arable farmland where home ranges may reach eight hectares (Wolton 1985, Tew et al. 1994). The bank vole, the only other species trapped in Ham Lands, also has recorded dispersal distances of up to 1,000 metres (Wolff 1999) which would also help to make them likely potential colonists. In woodland, Tattersall and Whitbread (1994) found that 20 per cent of wood mouse and 14 per cent of bank vole captures were arboreal (in the shrub and canopy layers) — such behaviour would further increase opportunities for transfer across boundary walls. Both species are habitat generalists and therefore more likely to benefit from the matrix of edge habitat found on Ham Lands than species with more specialist needs; for a discussion of habitat edge effects on small mammals see Lidicker and Peterson (1999).

Wimbledon Common had the second highest overall TNI, with the wood mouse dominating the catch in all habitats, including woodland where it is usually the most abundant species (Yalden and Shore 1991). The dominance was less marked in the grassland site which also supported a dense population of field voles, plus some bank voles and common shrews. That the grassland contained some scrub and was near a large area of mixed deciduous woodland helps to explain the success of the wood mice. These data rather conflict with the observation by Flowerdew (1991) that wood mice may avoid high densities of bank voles and field voles, but it may be that the mice preferentially exploit the scrub-dominated patches less preferred by field voles as shown by an American study of meadow voles *Microtus pennsylvanicus* and white-footed mice *Peromyscus leucopus* (Ostfield et al. 1999).

The overall TNI values (for numbers of individuals) from the two deer parks, Bushy (8.34) and Richmond (9.33), were much lower than from Wimbledon Common (42.75) and Ham Lands (61.04) but there was also considerable variation between the habitats sampled within each area. The TNI for Richmond Park is biased downwards because of the inclusion of improved (cut) grassland in the survey which yielded trivial catches and was not sampled in the other study areas; the TNI would rise to 12.71 if sampling from this habitat was excluded. Even so, both the deer parks have relatively very low TNI values.

Most of the catch from Bushy Park was from BP3, an uncut, ungrazed meadow. The low catch from the two woodland plantations in Bushy Park was surprising because the habitat appeared to be particularly suitable for wood mice, common shrews and bank voles. However, both plantations were fairly small and isolated by at least 200 metres of open grassland. Site BP2 (about 3 hectares) had five times the catch of BP1 (about 1.5 hectares) which may have been too small to support viable populations of wood mice. The field and bank voles and common shrews present may also have been exploiting the surrounding grassland, which would be much less suitable for wood mice. The much larger overall TNI values, dominated by wood mice, from woodland plantations in Richmond Park may reflect either their larger size (site RPG) or lack of isolation (sites RPB and RPC). On a wider scale, Bushy Park (and adjacent Hampton Court Park) is isolated in a loop of the River Thames, on the northern side. Bushy Park is also completely encircled by busy roads and a high perimeter wall, and surrounded by dense conurbation. Although Richmond Park also has a high perimeter wall, it is contiguous with several other open spaces (unlike Bushy Park), increasing the probability of immigrations. Over many years, the comparative isolation of Bushy Park (which is also smaller) may have had its effects on the small mammal community, but a dearth of wood mice seems to be an unlikely result.

The Morisita-Horn index showed the small mammal communities from Wimbledon Common and Richmond Park to be the most similar. This is in some ways surprising because of the major differences in the management of the two areas, for example Richmond Park is largely grassland managed to support about 700 deer whereas Wimbledon Common has no deer and much less grassland. However, both sites are very large and each provides a heterogeneous matrix of a number of vegetation types. They are also geographically close, but separated by a busy dual carriageway (the A3) and a narrow ribbon of urban development. The low index of similarity between Bushy Park and all other areas could be linked with its isolation from them, but the large differences in the abundance of wood mice would be a key influence on the index; the Morisita-Horn index is relatively sensitive to such contrasts (Magurran 1988).

Both Royal Parks are regionally important for their acid grassland community (Royal Parks Review 1996). The present study indicates that long, infrequently cut grasslands (sites WC3 and BP3) support much denser small mammal populations than shorter cut or closely grazed areas. Such grassland provides a suitable structure for covered runways, nest sites and cover from predators. It is also less disturbed because people tend to stay on paths where walking is easier and drier. Current grid-trapping work in progress in Richmond Park by one of us (N.J.R.) has found a high density of field voles in an area of uncut, acid tussock grassland. However, cover is not the only issue. The same current study has found that an area of former grassland densely colonized by bracken, which also provided dense cover but suppressed other ground vegetation, supported almost no small mammals.

The present study has been a first attempt to compare the small mammal communities of the open spaces of south-west London. Small mammals are a greatly under-studied component of biodiversity, despite their ecological importance. These relative abundance data are the best available at present, but each study is only a 'snapshot', which because of natural cyclic fluctuations in small mammal populations, might not represent typical densities. Therefore, there is a clear need for follow-up studies to investigate these communities more rigorously so that the above findings are either confirmed or overturned. More empirical research is needed to identify the key ecological factors influencing the composition and abundance of these communities.

As well as emphasizing the importance of areas of long, undisturbed grassland, our comparison of study areas and habitat patches within them has also highlighted the ecological effects of isolation. For example, in Richmond and Bushy Parks the grasslands are often fragmented by areas of dense bracken, wide belts of very short grass and broad paths. Voles and shrews are typically reluctant to cross open expanses. For example, Wolff (1999) noted that a barren strip four metres wide was a barrier to movement in grey-tailed voles *Microtus canicaudus*. The defragmentation of habitat patches could be achieved, with minimal impact on the traditional landscape, by the establishment of continuous belts of dense, uncut and undisturbed grassland, plus the creation of scrub corridors or hedgerows to connect isolated woodland sites. The optimum width of corridors varies for different species, but broader is not always better. Wider corridors may be perceived as habitat and, in territorial species, residents may deter migrants. Linear movements of tundra voles *Microtus oeconomus* and meadow voles *Microtus pennsylvanicus* were maximized with a corridor only one metre wide (Wolff 1999). On a wider scale, the defragmentation of isolated wildlife areas within the urban environment is highly desirable, although expensive and practically difficult. However, improving connectivity where sites are close, e.g. between Richmond Park (and its adjacent sites), Wimbledon Common and Ham Lands could be achieved by a combination of minor habitat creation schemes and protected wildlife underpasses.

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APPENDIX

Site descriptions

Eight-figure grid references approximate to centre of the trap lines.

1.1 Wimbledon Common (WC)

Site WC1. Heath: grid reference TQ 5232,1730.

Thirty-eight Longworths were set in groups of three at thirteen stations but with only two traps at the final station. A patch of heath bordered by copses and narrow strips of birch *Betula pendula* woodland. The ground vegetation was dominated by heather *Calluna vulgaris* with some cross-leaved heath *Erica tetralix*. Grasses included: purple moor grass *Molinia caerulea,* wavy hair grass *Deschampsia flexuosa*, fescues *Festuca ovina* and *Festuca rubra*, and Yorkshire fog *Holcus lanatus*. Occasional birch trees, pine *Pinus sylvestris* saplings and creeping willow *Salix repens* were present.

Site WC2. Clock house: grid reference TQ 5234, 1725.

Thirty Longworths were set at ten stations. An open patch of mixed deciduous woodland with dry soil. A central, partially cleared area had scattered deciduous trees, grasses, bramble *Rubus* spp. and bracken *Pteridium aquilinum* which had been treated with glyphosate herbicide to reduce its density. On the eastern side, bordering a residential area, was a dense strip of secondary woodland dominated by common oak *Quercus robur* and Turkey oak *Q. cerris* plus occasional birches. The understory was mainly holly *Ilex aquifolium*, brambles and sapling sycamore *Acer platanoides*.

Site WC3. The Plain: grid reference TQ 5234, 1721.

Forty five traps were set: thirty Longworth traps set in a line of ten stations, plus a further five stations each with three Anderson traps. An area of coarse long grass adjacent to mixed deciduous woodland. Grasses included: timothy *Phleam pratense*, cocksfoot *Dactylis glomerata*, Yorkshire fog *Holcus lanatus* and creeping soft grass *Holcus mollis*. Also present was heath rush *Juncus squarrosus*, nettles *Urtica dioica* and creeping thistle *Cirsium arvense*. There has been some scrub invasion but none above knee height. Brambles *Rubus* spp. were present at traps points 9 and 10. Scattered trees/shrubs included silver birch *Betula pendula*, dog rose *Rosa canina*, willows *Salix caprea* and *S.cinerea* and common oak *Q. robur*.

Site WC4. Cassels Chasm: grid reference TQ 5228, 1724.

Thirty Longworths were set in a line of ten stations. An area of secondary woodland (pollarded until the late 1960s) with a dense canopy sited in a wet valley. The principal trees present include beech *Fagus sylvatica*, common oak *Quercus robur*, Turkey oak *Q. cerris*, birch *Betula pendula* and *B. pubescens*, and sweet chestnut *Castanea sativa*. The understory was mainly holly *Ilex aquifolium* and brambles *Rubus* spp. with little else but mosses.

1.2 Bushy Park (BP)

Site BP1. The Canal Plantation: grid reference TQ 5150,1708.

Thirty traps (twenty-five Longworths and five Andersons) set at ten stations. Although fenced, deer could gain access by jumping a low wall; a stag was found in the plantation on two occasions. The habitat was woodland with a closed canopy and generally low, rather open understory (<50 cm tall) dominated by bramble *Rubus fruticosus*. The woodland was dominated by oak *Quercus robur* and alder *Alnus glutinosa* but with scattered hawthorn *Crataegus monogyna* and beech *Fagus sylvatica*. Small grass tufts were scattered amongst the brambles but rarely formed any continuous areas within the trapping area. Trap point 10 however was a more open area with grasses and rush *Juncus conglomeratus* co-dominant with brambles. No bracken *Pteridium aquilinum*.

Site BP2. Round Plantation: grid reference TQ 5150,1702.

Thirty traps (twenty-five Longworths and five Andersons) set at ten stations. No deer access. The woodland canopy varied from closed to open, dominated by oak *Quercus robur* with some Turkey oak *Quercus cerris*, silver birch *Betula pendula*, elder *Sambucus nigra*, sycamore *Acer pseudoplatanus* and willow *Salix* sp. The understory was dominated by tall brambles *Rubus fruticosa*, willowherb *Epilobium angustifolium*, nettles *Urtica dioica* and tall thistles *Cirsium* spp. A damper area was indicated by a patch of rushes *Juncus effusus*. No bracken.

Site BP3. The Brewhouse Meadow: grid reference TQ 5146,1701.

Thirty traps (twenty-five Longworths and five Andersons) set at ten stations. Rough improved grassland, formerly cut for hay but not cut for three years. Species present included rye grass *Lolium perenne*, occasional tufts of canary grass *Phalaris arundinacea*, cocksfoot *Dactylis glomerata*, thistles *Cirsium* spp. and dock *Rumex* sp.

1.3 Ham Lands (HL)

Site HL1. The Water Meadow: grid reference TQ 5167,1731.

Thirty traps (twenty-five Longworths and five Andersons) set at ten stations. The margin of a densely wooded hedgerow running along a river bank bordering a recently mown flood-meadow. Traps were placed along the margin of the grass and hedgerow. Trees included cherry *Prunus* spp., field maple *Acer campestre*, willows *Salix* spp., elder *Sambucus nigra*, elm *Ulmus glabra*, and the understory included brambles *Rubus* sp., nettles *Urtica dioica*, etc.

Site HL2. Thames Young Mariners site: grid reference TQ 5166,1724.

Thirty traps (twenty-five Longworths and five Andersons) set at ten stations. Traps were placed along the border of a mown lawn and a vegetated (shrubs, trees and longer grass) steep bank sloping down to an artificial lake. Trees/shrubs included cherry *Prunus* spp., elder *Sambucus nigra*, rowan *Sorbus aucuparia*, sycamore *Acer pseudoplatanus*, apple *Malus* spp., Japanese knotweed *Fallopia japonica*, bramble *Rubus* sp.

Site HL3. Reed Bed site: grid reference TQ 5166,1721.

Thirty traps (twenty-five Longworths and five Andersons) set at ten stations. Traps were placed along the margins of copses and rough grassland including (from stations 4–10) the boundary of a reed *Phragmites* bed and rough grassland with various shrubs and trees. Species included elder *Sambucus nigra*, hawthorn *Crataegus monogyna*, bramble *Rubus* sp., nettle *Urtica dioica* and golden rod *Solidago virgaurea*.

1.4 Richmond Park (RP)

Site RPA. The Conduit Stream area: grid reference TQ 1907,7420.

Sixty traps set at twenty stations spaced at roughly 5 m intervals. Acid grassland in which the trap line ran roughly south-north parallel to, but several metres away from, a small stream. The line ran down a shallow incline to a poorly drained area crossed by a gravel and sand bridle path and continued beyond it. The upper area of the line was dominated by tall bracken *Pteridium aquilinum* with occasional hawthorn *Crataegus monogyna* trees and an understory including yorkshire fog *Holcus lanatus*, nettle *Urtica dioica*, chickweed *Stellaria* sp. and a variety of mosses. The line then entered rough grassland with a dense cover of *Festuca rubra, Agrostis tenuis* and *Agrostis canina*. The lower area was dominated by large tussocks of *Deschampsia cespitosa* with purple moor grass *Molinia caerulea* and rushes, soft rush *Juncus effusus* and flowering rush *Butomus umbellatus*. The LUC (1984) survey also noted common rush *J. conglomeratus* and hard rush *J. flexus*. Other grassland species included creeping soft grass *Holcus mollis*, lady's bedstraw *Galium verum*, buttercup *Ranunculus* sp., violet *Viola* sp., clover *Trifolium* sp. and creeping thistle *Cirsium arvense*. There was some evidence of small mammal runways around the ant heaps. This area was treated with sewage sludge and then cut in 1982.

Site RPB. Bog Dump Plantation: grid reference TQ 1930,7440.

Thirty traps set at ten stations spaced at roughly 5 m intervals at the south-western end of a fenced plantation with very mixed ground vegetation consisting of areas of very short rabbit-grazed sward (many rabbit droppings and digging evident), deep leaf litter and dead wood, dense long grass with brambles *Rubus fruticosus*, rushes (possibly the flowering rush *Butomus umbellatus*), and teasel *Dipsacus fullonum*, nettle *Urtica dioica*, globe thistle *Echinops spaerocephalus*, vetches *Vicia* spp., ragwort *Senecio jacobaea*, buttercup *Ranunculus* sp., bedstraw *Gallium* sp. and yellow pimpernel *Lysimachia nemorum*. Soil surface lichens (e.g. *Cladonia* spp.) and mosses were abundant and bracken *Pteridium aquilinum* was present in some areas of the enclosure. Turkey oak *Quercus cerris* dominated the canopy but a mixed wooded area including: silver birch *Betula pendula*, oak *Quercus* spp., beech *Fagus sylvatica*, hornbeam *Carpinus betulus*, elder *Sambucus nigra*, sycamore *Acer pseudoplatanus* and willow *Salix* sp.

Site RPC. Teck Plantation: grid reference TQ 1996,7447.

Thirty traps set at ten stations spaced at roughly 5 m intervals in a densely vegetated fenced plantation. The dense bramble restricted access hence trapping stations were confined to the western part of the plantation where some more-open areas of leaf litter allowed reasonable access. The ground vegetation included a dense shrub layer with an abundance of brambles *Rubus fruticosus,* rhododendron *Rhododendron* sp. Nettle *Urtica dioica* and cleavers *Galium aparine* were very abundant, ivy *Hedera helix* was present on the ground and also covered some tree trunks. Other species present were dock *Rumex* sp., bedstraws *Galium* spp., and buttercups *Ranunculus* spp. Some unidentified umbellifers and mosses were also present. The tree canopy consisted mainly of Turkey oak *Quercus cerris* but also holly *Ilex aquifolium* elder *Sambucus nigra*, elm *Ulmus procera*, sycamore *Acer pseudoplatanus* and yew *Taxus baccata.*

Site RPD. Flying Field: grid reference TQ 2043,7370.

Sixty traps set at twenty stations spaced at roughly 5 m intervals along the border of a drainage ditch with longer grasses and clumps of rushes on the sloping ditch sides. The traps were laid bordering short improved grassland with a 31–50 per cent cover of fine grasses, 3–10 per cent cover of thistle (LUC 1984). This area was treated with sewage sludge in the years 1981–1989, a factor known to be associated with the spread of creeping thistle.

Site RPE. Pond Slade area: grid reference TQ 1940,7220.

Thirty traps set at ten stations spaced at roughly 5 m intervals. This area was undisturbed acid grassland, dominated by large well-developed growths of tussock grass *Deschampsia cespitosa* with purple moor grass *Molinia caerulea*. The LUC (1984) survey categorized this area as having 51–75 per cent cover of fine grasses and a 31–50 per cent cover of tussock grasses. A more detailed vegetation survey has not yet been carried out.

Site RPF. Adam's Pond area: grid reference TQ 2075,7440.

Thirty traps set at ten stations spaced at roughly 5 m intervals in an area of rough improved grassland dominated by growths of tussock grass *Deschampsia cespitosa* and rushes (including sharp-flowered rush *Juncus acutifloris* and flowering rush *Butomus umbellatus*). Fine-leaved grasses were present including bent *Agrostis* sp. and timothy grass *Phleum pratense.* Creeping thistles *Cirsium arvense* were common, buttercups *Ranunculus* spp. and thyme-leaved milkwort *Polygala serpyllifolia* were present. Trees in the area were scattered or in small clumps and were alder *Alnus* spp. and oak *Quercus robur.* The trapping site also included an area of very short mown improved grassland in which the total lack of cover meant that the trap line had to be abandoned and twelve traps (none of which yielded any catch) were set among the grass and fencing around the bases of four oaks in the vicinity. This area received sewage sludge treatment in the years 1981–1989.

Site RPG. Sidmouth Wood: grid reference TQ 1910,7340.

Thirty traps set at ten stations spaced at variable intervals along the Sidmouth Ride on the edge of mixed woodland of chestnut *Castanea sativa*, silver birch *Betula pendula* and Turkey oak *Quercus cerris* with brambles *Rubus fruticosus* and bracken *Pteridium aquilinum* dominating the understory. A more-detailed vegetation survey has not yet been carried out.

Postscript

A single parous female yellow-necked mouse *Apodemus flavicollis* was caught ten times between 29 August and 3 September 2000, on the edge of a grid of a hundred traps located in bracken-dominated acid grassland (Grid ref. TQ 5794,1726). This record is a new species for Richmond Park, and was not found in studies of the same trapping grid in spring 1999, autumn 1999 and spring 2000.

Book reviews

Checklist of the flora and fauna of Wicken Fen. Compiled and edited by Laurie Friday and Basil Harley. Harley Books, Colchester. 2000. 244 × 172 mm, 128 pp., paperback. ISBN 0 946589 61 5. £12.50.

This work forms a companion to *Wicken Fen — the making of a wetland nature reserve*, also edited by Laurie Friday and published by Harley Books in 1997 (see review in *Ent. Rec.* **110**: 95–96). In that work, species lists were omitted on the grounds that they were so lengthy that they would have necessitated either the use of very small type or else the raising of the cover price to an unrealistic level. That work is priced at £37.50. In the present work, the briefest of introductions precedes 98 pages of species lists, providing one of the most comprehensive site lists available for any site in Britain.

To review the species content of the list seems churlish. Both authors have consulted widely to ensure that the lists are comprehensive, accurate and up to date in terms of nomenclature, and I have every confidence that they are so. Anyone who claims to have records that are omitted is surely likely to be guilty of not sending in his or her records in any event! It is a pity, on the other hand, that the year of the most recent record is not given. Although sources are noted at the start of each section, and from these the latest dates can be inferred in some cases (e.g., there appear to no records of Oligochaeta since a list published in 1932), the list is nevertheless an *all time* inventory, with no indication of which taxa are still present. Thus for the Neuroptera, which list I myself scrutinised for the authors, we are advised that records are taken from Lucas (1925 and 1928), Gambles & Kerrich (1932), Imms (1932) and C. W. Plant. Presumably, then, my own records are the only ones made since 1938. I know for a fact that not all of the 13 species listed are based on my records, but the list does not allow the reader to discern which are which; for all the reader knows there may only be a single species still present! The Lepidoptera list, on the other hand is rather better presented and it is clear that continued presence is implied unless an annotation indicates otherwise.

In spite of this one criticism, this work is a superb effort and the annotation of appropriate species with national status codes allows for a degree of interpretation. It has been well worth the lengthy wait. Those who already have the 1997 book will certainly wish to buy this list in order to complete the overall work; those who do not will nevertheless find the lists an inspiration as well as a valuable means of comparison with other sites and will doubtless be moved to purchase the first volume in order to set the lists into context.

Colin Plant

Maggots, murder and men — memoirs and reflections of a forensic entomologist. Zakaria Erzinçlioğlu. Harley Books, Colchester. 2000. 256 pp., 232 × 150 mm. Paperback, ISBN 0 946589 65 8. £13.95.

I had heard of 'Dr Zak' for many years before finally hearing him lecture — it was well worth the wait. Now, one of the world's leading authorities on blowflies has committed to paper his vast and fascinating experience as a forensic entomologist. Again — it was well worth the wait. Murder, or at least the importance of forensic entomology in the solving of it, occupies a fair few of the pages in this book, and there are some familiar cases, which many readers will recall from the press or television news. But there is much more, and always written in a manner that is amusing yet which at once conveys to the reader that this author truly knows what he is writing about. There is the account of the man with lobsters up his nose! Then there is the tracing of the origin of a consignment of cannabis to a precise region of Burma as a result of identifying insects in with the leaves, overlaying their world distribution and looking for the point where all maps coincided. I suspect, however, that the author would be grateful for some emphasis here on his final chapter, in which he has a bit of a swipe at the present status (or should I say lack of status), of forensic entomology in Britain and puts the case for its development — funded by the state but, like the judiciary theoretically is, independent of it. This is an easy-to-read, fun book with a serious message and well worth every penny of the price.

Colin Plant

Restoring salmon *Salmo salar* to the River Thames; the work of the Thames Salmon Trust

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This paper was presented at the Society's conference 'The Thames Revisited', held with The Linnean Society of London at Burlington House, Piccadilly on 14 October 2000.

The history of the restoration of the Thames and the return of wildlife to its lower reaches in the 1970s is now well known and has been described by several authors, for example Harrison and Grant (1976) and Wheeler (1979). The key to this restoration lay in the effective control of pollution in the tidal reaches (essentially that part of the river downstream of Teddington to the North Sea) and the concomitant control of activities affecting the river from source to mouth. The major factor governing this later change has been the creation of a national controlling authority in the National Rivers Authority (later given wider powers and responsibility as the Environment Agency in 1996).

This restoration of the lower Thames and the decrease of pollution resulted in the presence of fish all year round and in considerable numbers, although their numbers and the species changed with the seasons and the species composition of the fish fauna has changed thereafter. Previously, up to the 1970s, there were very few fish present in the summer months when the warmer temperatures caused a diminution in the amount of dissolved oxygen in the water. Even while the improvement in the river was in its early days the thoughts of optimists had turned to the possibility that it might become possible to restore salmon *Salmo salar* to the river. As early as 1973 the Thames Migratory Fish Committee had been formed to discuss the possibility of reintroducing this species by ensuring the physical, chemical and biological conditions that would be required. However, it was accepted by this Committee that it was doubtful 'whether the size of the salmon and sea trout stocks had approached those of the major game fish rivers in the west and north of Britain'. (It is important to emphasize that from the outset this Committee was healthily aware that the Thames would never become a major salmon river and that claims of super abundance in the past had been gross exaggeration).

The major contribution made to this report was by Mr W. G. Hartley, then of the Ministry of Agriculture, Fisheries and Food, and an authority on the salmonid rivers of England and Wales, who made a personal inspection of all forty-four weirs on the Thames and assessed the type of fish pass that would be needed to be constructed to enable migrating fish to overcome the obstacle each weir posed. The objects of the Thames Migratory Fish Committee were to establish in what way the Thames could be improved to allow the passage of fish, particularly the migratory species, such as salmon, sea trout *Salmo trutta*, eels and also the less well known anadromous fish (species which moved into fresh water to breed, such as the shads *Alosa* spp. and smelt *Osmerus eperlanus*). Of these the most important in terms of revenue were the salmon and the trout (and the salmon captures the imagination in a way that no other freshwater species does). To complete its life-cycle the salmon requires access to a large part of the river in which it was hatched, to the open sea in which it feeds and attains sexual maturity before migrating upstream to spawn. This highlights the importance of Hartley's study of the Thames weirs, every one of which could have proved an obstacle to migrating salmon. To counter these obstacles each weir had to be provided with a fish pass, which would allow passage upstream to the potential spawning beds. Spawning beds for salmon are not just patches of gravel but the gravel has to be composed of pebbles of appropriate size which allows the water to pass through it, thus allowing oxygen to reach the eggs as they develop (the breeding fish lay their eggs in shallow trenches, known as redds, which are made in the river bed by the adults).

During the century and a half of years in which pollution had made the lower Thames impassable for migratory fish it had been an important highway for river traffic and increasingly the needs of commerce or recreational boating had become paramount to fisheries. This resulted in dredging of the river bed and the improvement of the flow of water, which was not necessarily to the advantage of the fish living in the river and certainly interfered with breeding sites. So, making the Thames suitable for the re-establishment of salmon involved both major engineering work on the weirs by the construction of fish passes (salmon ladders) and the re-creation of the spawning beds which had been lost or altered by changes to the river bed and the river banks.

The Thames Migratory Fish Committee (which reported in April 1977) addressed the problem of finding suitable spawning sites for salmon in the river's present altered state and concluded that they were very scarce in the Thames itself but suggested that 'limited spawning grounds may exist in the River Kennet' and in other tributaries in the Thames catchment. An experimental introduction of salmon fry in the Eye (a tributary of the Windrush), referred to in the Committee's Report showed that there was a good prospect of rapid growth and successful production of one year old smolts (which are young salmon about to migrate to sea). Once it had been established that young stages of salmon could thrive in some of the upstream tributaries it became clear that it would be an economical short cut to re-establishing salmon because young fish could be stocked with reduced distances to travel both on their downstream migration to the sea and significantly less distance for adult salmon to return to the stream in which the young fish had been hatched.

An increase in the number of salmon returning from their migration to sea could be achieved by assisting their passage upstream. Accordingly it was proposed to install a trap in the lower reaches of the Thames at Molesey Weir which is the first weir above Teddington (which was made more easily passable for salmon). Originally, it was proposed to install an automatic fish counter in the trap but unfortunately it was never built. Salmon returning to the Thames could then either be transferred to the tributary river which was thought to show most promise as a spawning site, or their eggs and milt could be stripped from them (which is a routine procedure in fish culture) and does not damage the fish. The fertilized eggs can then be reared until they hatch and the young fish can be grown on until they are larger and can withstand being turned out into the river. With modifications this scenario has been followed since the setting up by the Thames Water Authority of a Working Party on Thames Migratory Salmonids in July 1977. This Working Party represented a wide range of organizations with an interest in the Thames and its fisheries.

The reports of the Thames Migratory Fish Committee (1977) and the Working Party on Thames Migratory Salmonids (1978) showed there was a probability that the river could become inhabited by salmon and sea trout, but that many difficulties would need to be overcome. In addition, the management of the Thames had been fragmented at that period in that the bodies responsible for the river had been the Port of London Authority below Teddington (with the Greater London Authority responsible for the condition of the water and other local authorities downstream to the mouth of the river) with the Kent and Essex Sea Fisheries Committee in charge of regulation of fisheries near the seaward end of the estuary. Above Teddington the river was under the control of the Thames Conservancy for fisheries and navigation and, of course, many local authorities had responsibilities for discharges to the river from sewers and drains. The control of the river became rationalized to a major extent by the creation of the National Rivers Authority in 1989 and by the even greater powers of the Environment Agency in 1996. This last development resulted in the Environment Agency becoming solely responsible for the control of fisheries in the Thames, as well as such matters as drainage, pollution, navigation and the upkeep of weirs and lock gates.

Unfortunately during the 140 years in which migratory fish found the Thames impassable for one reason or another no attempt was made to ease the way for migrant fish, indeed in most places any salmon seen were captured and sold. The classic case was the record of captures at Boulter's Lock, Taplow, where for twenty-seven years the Lovegroves, who owned the mill there, caught 499 salmon between 1794 and 1821. These fish were caught in traps associated with the weir, which caught most, if not all, the migrating salmon. This and other weirs made the river practically impassable to salmon and trout and local extinction was inevitable.

Once the decision had been taken to attempt to re-establish the salmon in the river, work to build fish passes (salmon ladders), which would allow fish to migrate upstream to breed, had to be considered. A total of forty-four weirs required the construction of fish ladders between Teddington and the headwaters of the Thames but if the main thrust of salmon introduction branched off up the Kennet the number would be reduced to twenty. Because building fish passes is an expensive operation, the Thames Salmon Trust was set up to raise money with which fish passes could be built. The Trust's first chairman was Mr Roy Watts (Chief Executive of Thames Water) but after his sudden and premature death the chairman became Sir Geoffrey Johnson Smith, MP from 1986 to date. Sir Hugh Fish was an important figure in working to re-establish the salmon as an endemic fish in the Thames, both during his career in the water industry and after his retirement. Hugh Fish was at one time the River Engineer of the Essex River Board: he later became a member of the Thames Conservancy and the Director of Scientific Services of the newly formed Thames Water Authority and in time its Chief Executive. Later he became Director of the Natural Science Research Council and in retirement, a Trustee of the Thames Salmon Trust. Sir Hugh's depth of knowledge of the industry and his broad knowledge of aquatic sciences made him a valuable member of the board of Trustees as well as a delightful companion when travelling along the Thames to open a new fish pass. The Appeals Director is Major John B. Hyslop who has played the major part in raising money from industry, corporate bodies, individuals, and the Millennium Commission (which supported the Trust with a grant of £588,000 which was set aside for the Kennet project). The Trust has received enormous support from the Environment Agency both at high level in the Thames Region and what I think of as wethands staff in the Fisheries Department. Among the staff of the Agency who played a major role in the restoration of the salmon in the Thames are Peter Gough, Greg Armstrong, John Banks (who on his retirement became an active Trustee of the Trust) and Darryl Clifton-Day (who is currently the Environment Agency's officer in charge of the Thames Salmon Rehabilitation scheme).

The results of nearly twenty years of building salmon passes and stocking the river with young salmon (with the object of stocking 210,000 salmon each year; 150,000 being fry and 60,000 smolts annually) means that there are numerous salmon in the river today. However, they are by no means evenly distributed throughout the river, or from year to year. The numbers of returning salmon each year are erratic with high numbers in 1988 of 323 fish and 1993 of 338, but in intervening years like 1998 with only six fish caught (although in 1999 there were thirty-six fish). To bring the numbers up to date (November 2000) fifty-five adults have been caught in the traps at Molesey and Sunbury by anglers or by the Agency's fisheries staff. This is the highest adult return for three years and is an inspiring total after a number of disappointing years. The earliest summer fish caught during 2000, was trapped at Molesey on 23 June, and weighed 11lb. The restoration of salmon to the Thames is making good progress but is not yet over all its problems. For example, there are still five more passes to be opened, although these have been designed, but building is held up in some cases by local difficulties. Moreover, the one problem that may affect the whole project is something that none of the individuals involved in the project in its early days could have ever imagined, the distinct change in our climate that has occurred in the last ten years. Warmer summers are certainly not what we need to establish the salmon population.

Acknowledgements

I thank Major John Hyslop and Darryl Clifton-Day of the Environment Agency, and Dr John Banks for their help with information on the Trust.

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The birds of the Inner Thames — an avian highway

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Introduction 131
Setting the scene 131
Winter 131
Gulls 132
Passage 132
Breeding 133
The future 133
Acknowledgements 133
Species referred to in the text 133

Introduction

The River Thames forms a significant part of the London Area and has a profound effect on the birdlife of the capital. Although the river is tidal for much of its length within the London Natural History Society recording area the main tidal influence affecting birds occurs from Tower Bridge downstream. This sector of the river is the Lower Thames (when viewed from a London perspective) or the Inner Thames, when the whole estuary is taken into consideration (for Wetland Bird Survey counts etc.).

Setting the scene

At the edge of the London Area at Tilbury the River Thames is a wide slow-moving river with its greatest tidal extremes. Historically the surrounding land was low-lying marsh and grazing marsh but this has now been largely replaced by industrial development. The extreme tides create several areas of extensive mudflat that are of particular importance to waders and ducks. Several rivers also join the Thames along this part of the river (including the Darent, Beam, Roding, Ingrebourne and Lea), creating freshwater outflows, which again attract feeding wildfowl, terns and gulls.

Also exiting into the river are warm-water outfalls from power stations (as at Littlebrook, Crossness and the former West Thurrock) and sewage outfalls (as at Barking/Creekmouth). These attract a variety of gulls, terns and ducks, particularly during passage and winter.

Although the Thames has been heavily industrialized along its banks there are some compensations. A significant part of Rainham Marsh has now been safeguarded by the creation of the new RSPB reserve on site. Several large landfill sites have had the rather dubious distinction of attracting numbers of gulls to the river, some of which have now started to breed.

Winter

During the last decade there have been subtle changes to the winter populations and distribution of wildfowl and waders using the Thames. There was a significant decline in the late 1980s and 1990s in several species (teal, mallard, pintail and pochard being the most obvious examples). This was probably linked to the shift upriver of the *Tubifex* worms that provided the bulk of the food supply in winter. As the Thames became cleaner so the *Tubifex* worm zone (which can tolerate quite polluted conditions) began to move upriver west of the Thames Barrier. Although recent combined counts along the whole of the Inner Thames indicate that there has not been a great decline overall in the wintering population of ducks it would appear that most species (with the exception of pintail and pochard) have merely become more dispersed

The same is true of the waders with a shift upriver during the last decade as the water has become cleaner. However there has been a recent decline in the overall wintering wader population using the Thames due in part to the lack of suitable high tide roosts. During the late 1980s and early 1990s up to 22,000 dunlin and 3,000 redshank used the ash lagoons at West Thurrock Power Station as a high tide roost. This roost, one of the largest along the Thames, attracted birds from a significant part of the Inner Thames. With the closure of the power station in the early 1990s the roosts were displaced and the large numbers have not been recorded since. As the majority of the birds using the roosts fed on local mudflats (i.e. within the Inner Thames) the wintering numbers on the whole section of the river have fallen. One slight consolation is that some species — particularly dunlin and redshank — now occur in numbers further upstream than in the past.

Some duck species have shown increases in the last decade and this can be linked with the availability of Thames-side roost and feeding sites. Management work at Rainham Marsh in 1998 created areas of waterlogged grazing marsh on the former MoD firing range. This has attracted up to 500 wigeon, 220 shoveler and 250 gadwall onto the site, which regularly commute from the marsh to the Thames according to tidal and feeding conditions. In 2000 pumping operations on the silt lagoons at Rainham Marsh were also reinstated, attracting teal (1,000) shoveler (100+) pochard, tufted duck and gadwall.

The Thames also provides a winter refuge for several species owing to its slightly warmer climate — particularly in severe weather. The old Thames of the middle ages regularly used to freeze completely but even during quite severe winter weather has not done so in the last thirty years. From Rainham downstream the saline influence is so strong that slightly warmer frost-free conditions prevail influencing the riverside. This has encouraged regular wintering of passerines — water and rock pipits in particular. Both have shown a marked increase in winter numbers during the last decade and several other passerine species have found winter survival better along the River Thames than elsewhere.

Gulls

Large landfill sites have been a feature of both the Kent and Essex shores for many years and attract large numbers of gulls in particular. Although these have been in existence for many years, there are now subtle changes taking place within the gull population structure. The most widespread gull species throughout the year is the black-headed, but increasing numbers of herring and lesser black-backed gulls are now present along the Inner Thames throughout the year. From the mid 1980s onwards both species began breeding in Inner London on a regular basis, followed in the 1990s with breeding at several sites along the river downstream of Tower Bridge. The availability of regular feeding sites at landfills in Essex and Kent (as well as Billingsgate fish market, now located in east London) as well as the spread of breeding colonies from Suffolk along the Essex coast — presumably offshoots from the Low Countries — has greatly contributed to this increase.

There has also been a corresponding increase in the numbers of rarer gulls along Thames-side since the late 1980s, particularly with the yellow-legged gull (now a regular late summer and autumn visitor), Mediterranean gull and both glaucous and Iceland gulls.

Passage

One of the downsides of recent years has been the closure of West Thurrock and the run down of Littlebrook Power Stations. Both these sites attracted substantial numbers of terns and other seabirds during spring and particularly autumn passage between the mid 1970s and the early 1990s. The warm-water outfalls and their associated rich food supply formed a chain stretching from Tilbury Power Station (outside our area) right along the Thames. Terns were the most numerous species (with over 500 common and 300 black for example) but several typical seabirds — petrels, shearwaters and skuas also became far more regular on the Inner Thames. Currently only the outfall in Barking Bay is still extant and although attracting fair numbers of terns and other seabirds (including Sabine's gull and white-winged black tern) is probably a little too far upstream to recapture the heyday of the late 1980s.

Breeding

Apart from the increased breeding gull population several other species have benefited from the cleaner conditions on the River Thames in recent years. Oystercatchers now breed along the whole of the Inner Thames from Docklands downstream, many pairs making use of the numerous jetties and other man-made structures that exist on this stretch of the river. Shelduck have also extended their range upriver to Docklands with for example over 100 young being reared in the Barking Bay/Crossness area in 1997. Small patches of reed and salting now being established further upstream yearly attract breeding reed warbler, reed bunting and even the occasional redshank pair.

The future

With much cleaner conditions now prevailing along much of the Inner Thames and its foreshore the numbers and diversity of bird species is set to maintain the improved situation of the last decade. Other positive developments on the surrounding floodplain will also encourage the improved avian presence along this stretch of the river. This is best illustrated by the example of Rainham Marsh where the RSPB, working in collaboration with English Nature, the Environment Agency and Cleanaway among others, have put in motion plans to safeguard a significant stretch of the river, its foreshore and floodplain. With so much pressure for industrialization on surrounding land further up and down stream it is vital that such projects are seen to fruition and possibly developed elsewhere (e.g. at Dartford Marsh). There is still a great need for a secure high tide wader roost on this stretch of the river to recapture the significant feeding and roosting numbers of the late 1970s and 1980s. It would be ironic if the cleaner river could not support breeding and wintering bird populations due to the absence of roosting, feeding and breeding sites along the Inner Thames.

Acknowledgements

I would like to thank Colin Bowlt and Keith Hyatt for the encouragement to write this paper and all the dedicated observers who have contributed to our knowledge of the birdlife of the Inner Thames.

Species referred to in the text

Wigeon	*Anas penelope*	Lesser black-backed gull	*Larus fuscus*
Gadwall	*Anas strepera*	Herring gull	*Larus argentatus*
Teal	*Anas crecca*	Yellow-legged gull	*Larus michahellis*
Mallard	*Anas platyrhynchos*	Iceland gull	*Larus glaucoides*
Pintail	*Anas acuta*	Glaucous gull	*Larus hyperboreus*
Shoveler	*Anas clypeata*	Common tern	*Sterna hirundo*
Pochard	*Aythya ferina*	Black tern	*Chlidonias nigra*
Tufted duck	*Aythya fuligula*	White-winged black tern	*Chlidonias leucopterus*
Redshank	*Tringa totanus*	Rock pipit	*Anthus petrosus*
Dunlin	*Calidris alpina*	Water pipit	*Anthus spinoletta*
Mediterranean gull	*Larus melanocephalus*	Reed warbler	*Acrocephalus scirpaceus*
Sabine's gull	*Larus sabini*	Reed bunting	*Emberiza schoeniclus*
Black-headed gull	*Larus ridibundus*		

Book reviews

The Apothecaries' Garden. A new history of the Chelsea Physic Garden. Sue Minter, with research by Ruth Stungo. Foreward by HRH The Prince of Wales. Sutton Publishing Ltd, Stroud. 2000. 210 pp., A4, 100 b/w illustrations, 20 colour plates. £25 hardback. ISBN 0 7509 2449 7.

This book tells the fascinating story of the Chelsea Physic Garden from its origins in 1673 down to the present day. The contribution that this remarkable garden has made to the wider world of botany and horticulture has been immense. It was set up originally by the Worshipful Society of Apothecaries of London as a teaching establishment for the appreciation of 'the power and glory of God in the works of the creation and that their apprentices and others may the better distinguish good and usefull plants from those that bear resemblance to them and yet are hurtfull'. By its heyday, in the eighteenth century, it had become the most famous botanic garden in Europe, being visited by Linnaeus himself in 1736. The author, Sue Minter, is the current (and first female) curator of the Garden. She follows a long line of distinguished predecessors who worked at the Garden. They include, among others, Philip Miller (1691–1771), author of the renowned *Gardeners Dictionary*; William Curtis (1746–1799), author of the exquisitely illustrated *Flora Londinensis* and the, still running, *Botanical Magazine*; William Forsyth (1734 –1804), commemorated by the familiar spring shrub *Forsythia;* and Robert Fortune (1812–1880), the great explorer and plant collector. The Garden's greatest benefactor, however, was the physician, naturalist and botanist Sir Hans Sloane (1660–1753), to whom the book is dedicated. It was his shrewd foresight, in 1722, to grant a leasehold of the land to the Society of Apothecaries through a deed of covenant whose carefully worded terms and conditions have assured the survival of the Garden through the many vicissitudes that have beset it during its long history. Sue Minter has done an excellent job unravelling and pulling together the many complex strands of this story and her book is the first to bring it fully up to date with an account, in the final two chapters, of the Garden in the twentieth century. The numerous illustrations are of a very high standard and nicely complement the text.

London's 'Secret Garden' has been open to the public on a regular basis since 1983. It is a magical place. For all those with an interest in the history of medicine, plant introductions, botany or gardening, this book is highly recommended.

David Bevan

International Code of Botanical Nomenclature (Saint Louis Code). Edited by a committee under W. Greuter (Chairman) and D. L. Hawksworth (Secretary). Published and distributed by Koeltz Scientific Books, D-61453 Koenigstein, Germany. 2000. 474 pp. Approx. £30. ISBN 3 904144 22 7.

This is the latest hexennial revision of the *International Code of Botanical Nomenclature*, the document containing the rules governing how plant taxa of all kinds, including fungi, fossils and hybrids (which for some reason is in an Appendix instead of being numbered with the rest). A preface by W. Greuter and D.L. Hawksworth sets out the differences from the previous revision. One might think that the *ICBN* has little relevance to the activities of the London Natural History Society, and one would be right but for one point. The previous 'Tokyo' code had instituted a rule for a system of registration of new botanical names, to become mandatory from a future date. This was intended to prevent the publication of valid new names in places where they might be overlooked, creating potential problems. This has now been thrown out, so it is again allowable to publish a new name even in somewhere as relatively obscure and local as *The London Naturalist.*

Rodney Burton

Changes in the marine algal flora of the tidal Thames: a millennium review

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This paper was presented at the Society's conference 'The Thames Revisited', held with The Linnean Society of London at Burlington House, Piccadilly on 14 October 2000.

Abstract 135
Introduction 135
The tidal Thames as an environment for algae 135
Methods 136
The marine algal flora: early records 137
The marine algal flora in 1976 137
The marine algal flora, 1976–2001 138
Discussion and conclusions 142
Acknowledgements 144
References 144

Abstract

Present and past information on the benthic marine algal (seaweed) flora of the Thames Estuary is compared. Man-made structures have replaced most of the natural marshy riparian environment and now provide the main habitats for algal settlement. Algal communities on sea-walls in the outer estuary are now those found on rocky shores. Since 1976 an upriver spread of species has been detected which reflects improved water quality and recent increases in salinity. It is concluded that the changes in the marine algal flora of the tidal Thames are significant and have both anthropogenic and natural causes.

Introduction

The first comprehensive account of the benthic marine macro-algal flora of the tidal river was presented at the 1975 London Natural History Society conference on the 'Natural History of the Thames Estuary' (Tittley and Price 1977). It provided a baseline of qualitative information against which change can be assessed. The present paper reviews algal records from the seventeenth century to the present, and describes changes in the marine flora of the tidal Thames.

The tidal Thames as an environment for algae

The Thames has undergone much change since the last glaciation. Isostatic readjustment causes south-east England to sink relative to sea level and therefore a marine transgression continues to affect estuaries and low-lying areas. The Thames Estuary has sunk 6–7 metres since the first century AD at which time the tidal limit probably lay near Westminster (Jenkins 1983, Weightman 1990); the river then was much wider, shallower and slower flowing.

Considerable alteration to the tidal river has been brought about by human settlement in the area, the river's use as a navigable waterway and as a facility for waste discharge. The drainage of marsh and the construction of embankments, wharves and piers began during the Roman period (Goodsall 1965) and continued with the growth of London and other towns (Barton 1992, Tinsley 1998, Weightman 1990). Side (1973) outlined changes in vegetation after the exclusion of tidal water at a site in the outer estuary; the disappearance of *Enteromorpha* spp. was recorded. Natural erosion due to the rise in sea level has also contributed to the loss of waterfront marshes (Steele 1999). The reduction of wetland coast has been accompanied by the construction of stable embankment. As a consequence the Thames has become narrower, deeper and faster flowing. The old London Bridge acted as a tidal barrier and when demolished in the early nineteenth century water movement caused the river to be deepened. Many of the tributaries of the Thames, especially those in London, have become enclosed as culverts and have ceased to be estuarine features (Barton 1992). Another contrast with the modern river was that above the old London Bridge the river froze in severe winters; river water there was fresh but occasionally became salty when there was a low flow from upriver (Weightman 1990). Tidal influence in the nineteenth century reached Staines (Tinsley 1998) but is now at Teddington 93 kilometres from Southend and Sheerness at the mouth of the estuary. Tidal amplitude at London Bridge is now considerable, 8 metres at spring tides compared with 4 metres in 1791 (Weightman 1990).

There have also been considerable changes to the river's water, not least, for reasons stated, the spread of saline water nearer to London. Water quality was generally of a high standard before 1800, although as early as the thirteenth century discharges in London made river water locally unfit to drink (Barton 1992, Weightman 1990). Between 1800 and 1850 water quality deteriorated significantly due to chronic pollution by domestic and industrial waste (Jenkins 1983, Halliday 1999, Weightman 1990). River water remained poor in quality until the mid twentieth century since when it has improved dramatically (cf. Attrill 1998). River temperatures vary seasonally and in the middle reaches have become elevated because of discharges to the river. Water turbidity causing low light penetration is also an important factor affecting the growth of algae.

Methods

Early records of algae were acquired in the course of literature and herbarium searches and are stored in manuscript form at **BM**. Field studies have been undertaken at thity-eight sites along the tidal Thames (Figure 1) at various times of the year. Sites at Gravesend, Greenhithe, Erith, Thamesmead and Woolwich have been investigated on several occasions between 1976 and 2001. Direct (qualitative) studies were undertaken with representative material collected for determination and the preparation of voucher specimens (at **BM**). Quantative studies have been undertaken at Woolwich, Thames Barrier, Charlton, and Wapping; sampling methods, and also the raw data, are given in Tittley (1982, 1985) and Cox and Tittley (2000). Methods used in the population studies on *Fucus vesiculosus* Linnaeus, and also the raw data, are given in Eugeniou (1993).

Algal nomenclature and author citation follows Guiry (1997).

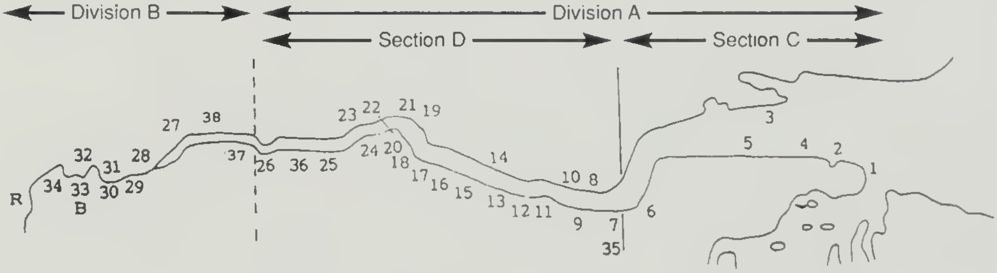

FIGURE 1. The Thames Estuary showing sampling sites and floristic divisions.

1 Grain, 2 London Stone. 3 Canvey I., 4 Allhallows, 5 Egypt Bay, 6 Shornmead, 7 Gravesend, 8 Tilbury, 9 Northfleet, 10 Tilbury Dock, 11 Swanscombe, 12 Greenhithe, 13 Littlebrook (Dartford), 14 Purfleet, 15 Long Reach, 16 Crayford Ness, 17 Erith marshes, 18 Erith, 19 Rainham, 20 Belvedere, 21 Dagenham Dock, 22 Crossness, 23 Barking, 24 Tripcock Ness, 25 Woolwich, 26 Greenwich, 27 Central London (Cleopatra's Needle), 28 Chelsea Bridge, 29 Battersea Bridge, 30 Putney Bridge, 31 Nr. Barn Elms, 32 Hammersmith Bridge, 33 Barnes, 34 Kew, 35 Gravesend Pier, 36 Thames Barrier/Charlton, 37 Deptford Creek, 38 Wapping, B Barnes (freshwater study), R Richmond (freshwater study).

The marine algal flora: early records

Unlike for other parts of the coastline, the available information on the algal flora of the tidal Thames as specimens, published records, and descriptive ecological accounts is scant (Tittley and Price 1977). Unexpectedly, there is more information for the seventeenth and eighteenth centuries than there is for the late nineteenth and early twentieth centuries when algal collecting and study in Britain was at a peak (**BM** has no specimens from the Thames Estuary for this period). The highly polluted, industrial, and generally unhealthy (cf. Halliday 1999, Snow 2000) environment of the Thames of the nineteenth century with its low species-diversity was presumably not attractive to collectors who may also have found the otherwise extensive marshy areas not easily accessible (cf. Anon. 1999).

Nonetheless, the early specimen and literature records of algae from the middle reach of the Thames are a typical riparian assemblage of species characteristic of brackish and marshy conditions. Dillenius and Ray (1724) and Dillenius (1741) recorded the green alga *Enteromorpha intestinalis* (Linnaeus) Link, and the yellow-green alga *Vaucheria dichotoma* (Linnaeus) Martius from marsh ditches near Rotherhithe, Greenwich, Charlton and at Woolwich (the type locality of *V. dichotoma*, lecto- and topo-type specimens at **OXF**). *Vaucheria compacta* (Collins) Taylor was found by Dillenius (1741) in the river (in contrast to marsh ditches) between Greenwich and Woolwich. Ray (1696) recorded *E. compressa* (Linnaeus) Nees as occurring 'about London'; Dillenius and Ray (1724) recorded the species 'on the wall of the Thames about Woolwich' and Dillenius (1741) noted it from the Thames 'about Greenwich'. **BM** herbarium holds early nineteenth-century specimens of *E. intestinalis* from Battersea; these large distended plants probably grew in the undisturbed marsh pools that occurred there prior to embankment construction.

There are also early citations of algae from the lower, more saline, reaches; *Fucus vesiculosus* (Robinson 1686 MS letter in **BM**) and the green algae *Cladophora sericea* (Hudson) Kützing (Dillenius 1742) and *Enteromorpha linza* (Linnaeus) J. Agardh (Berkeley 1832 MS accompanying original illustration for *English botany* in **BM**) were observed at Gravesend. *Vaucheria dichotoma* was recorded from marsh ditches near Gravesend by Hudson (1778).

The nearest early records to London of *Ulva lactuca* Linnaeus (Johnson 1629) and *Fucus spiralis* Linnaeus (Martyn 1726 MS species list in **BM**) were from the mouth of the estuary at Sheerness. Of note is *Porphyra umbilicalis* (Linnaeus) Kützing whose type specimen from Sheerness (at **OXF**), was probably collected by Dillenius between 1721 and 1724 (Brodie 1998). The type specimen (in **BM**) of the red alga *Gloiosiphonia capillaris* (Hudson) Berkeley is also from Sheerness (Hudson 1778) and the common red alga *Ceramium nodulosum* (Lightfoot) Ducluzeau (specimens in **BM**) was collected there in 1729.

The marine algal flora in 1976

Tittley and Price (1977) identified four main types of habitat colonized by algae. These were, river walls, mussel–shingle–shell banks, floating structures, and saltmarshes. West of Woolwich river embankments carried a dense mat of vegetation dominated by Chlorophyta. Within this mat were successive zones relative to tide level and each was characterized by particular species (e.g. *Blidingia* spp. at high water level; *Enteromorpha* spp. at lower levels). Zonation was altered by factors such as shading, wave action and the nature of the substratum. In the lower reaches of the estuary the vegetation on seawalls at mid-littoral levels was characterized by large brown algae that formed a distinct zone below the mat of green algae at upper littoral levels. At Canvey Island in Essex and at Allhallows in Kent the canopy of brown algae contained zones of *Fucus spiralis* Linnaeus, *F. vesiculosus* and *Ascophyllum nodosum* (Linnaeus) Le Jolis. Beneath these algae was an underflora of small brown, green and red species. Mussel, shingle and shell banks occurred locally in the outer estuary and supported species not found further in, such as *Dumontia contorta* (S. Gmelin) Ruprecht and *Petalonia fascia* (O.F. Müller) Kuntze. Partially submerged floating structures carried populations of algae characteristic of sublittoral levels and not found on the seashore. The few remaining areas of saltmarsh were largely restricted to the outer estuary and contained assemblages of green algae and *Vaucheria* spp.

Tittley and Price (1977) recorded thirty-nine species of algae between Kew and Grain. The majority of brown and red algae were restricted to the more saline outer estuary. Species diversity decreased with increasing distance from the sea. Correlation of salinity with algal distribution patterns suggested four sections of the river each with a characteristic algal assemblage; these sections were not sharply defined but merged into one another. A marine section was identified to the east of Gravesend where mean salinity was close to or at that of full marine conditions (33 g/l) and which decreased up river to 26 g/l; fucoids were abundant and red algae an obvious component of the flora. An estuarine section was identified between Gravesend and Erith where salinity had decreased to 16 g/l; a fucoid cover was an obvious feature but red algae were rare. An extensive brackish section was identified between Erith and Putney where salinity had decreased to 2 g/l; mats of green algae characterized the vegetation on river walls. A tidal freshwater section (Putney to Teddington) contained freshwater and a few euryhaline species.

The marine algal flora, 1976–2001

Since 1976 the Thames Barrier has been built, river walls raised and reconstructed, new jetties and other structures built into the river, all of which create new habitats for algae. Water quality remains high but salinity has varied. The drought years of 1989 to 1992 affected freshwater flow to the estuary and in the short-term salinity profiles changed temporarily. In the medium term, the mean salinity recorded at Woolwich increased from 1.9 g/l in 1981–3 to 6.7 g/l in 1997 (Figure 2).

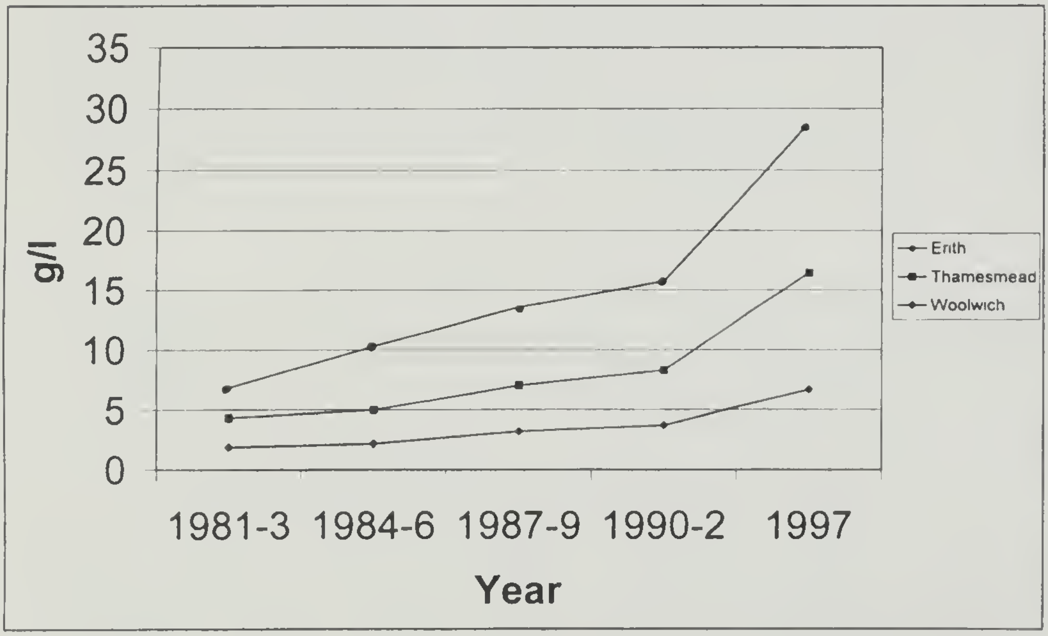

FIGURE 2. Graph showing increase in salinities, 1981–1997.

TABLE 1. Species recorded in the tidal Thames (for divisions and sections see Figure 1).

	Division A **Section C** **Outer estuary** **To Gravesend**	**Division A** **Section D** **Middle tidal river** **To Greenwich**	**Division B** **Inner tidal river** **Above Greenwich**
Audouinella daviesii	----------------		
Eugomontia sacculata	----------------		
Aglaothamnion hookeri	----------------		
Dumontia contorta	----------------		
Porphyra purpurea	----------------		
Polysiphonia fucoides	----------------		
Erythrotrichia carnea	----------------		
Chondrus crispus	----------------		
Petalonia fascia	----------------		
Monostroma grevillei	----------------		
Ralfsia clavata	----------------		
Rhodothamniella floridula	----------------		
Gelidium pusillum	----------------		
Bryopsis hypnoides	----------------		
Chaetomorpha mediterranea	----------------		
Ascophyllum nodosum	----------------		
Cladophora fracta	----------------		
Polysiphonia stricta	----------------	----------------	
Ceramium deslongchampsii	----------------	----------------	
Aglaothamnion roseum	----------------	----------------	
Elachista fucicola	----------------	----------------	
Cladophora sericea	----------------	----------------	
Ulva lactuca	----------------	----------------	
Fucus spiralis	----------------	----------------	
Fucus vesiculosus	----------------	----------------	
Pilayella littoralis	----------------	----------------	
Audouinella purpurea	----------------	----------------	
Vaucheria dichotoma	----------------	----------------	
Enteromorpha prolifera	----------------	----------------	----------------
Enteromorpha intestinalis	----------------	----------------	----------------
Urospora penicilliformis	----------------	----------------	----------------
Blidingia minima	----------------	----------------	----------------
Blidingia marginata	----------------	----------------	----------------
Rhizoclonium tortuosum	----------------	----------------	----------------
Ulothrix flacca		----------------	
Ectocarpus siliculosus		----------------	
Enteromorpha flexuosa		----------------	
Enteromorpha torta		----------------	
Porphyridium purpureum		----------------	
Bangia atropurpurea		----------------	----------------
Pseudendoclonium submarinum		----------------	----------------
Ulvaria oxysperma		----------------	----------------
Ectocarpus sp.		----------------	----------------
Vaucheria compacta		----------------	----------------
Cladophora sp.			----------------
Cladophora freshwater sp.			----------------

Recent studies have increased the species total for the tidal river to forty-six (Table 1) with new records at several sites.

In the lower reaches of the Thames, Price (1982, 1983) recorded changes in the occurrence of macro-algal species. Compared with 1976 *Fucus vesiculosus* in 1982 had advanced 2.5 km upriver to Dagenham Dock and *Ulva lactuca* was found 5.3 km further upstream. In 1988 Price (pers. comm.) recorded shallow sublittoral populations of *Aglaothamnion roseum* (Roth) Maggs & L'Hardy-Halos from floating jetties at Tilbury and Gravesend, and further upriver than previously known at Dartford. Also present on floating jetties at Tilbury were the red algae *Polysiphonia fucoides* (Hudson) Greville and *Ceramium deslongchampii* Duby; the siphonous green alga *Bryopsis hypnoides* Lamouroux was recorded there for the first time in the Thames.

Recent reappraisals at Gravesend (Tittley and John 1998; present study — January 2001) revealed on sea walls and foreshore boulders at upper littoral levels, zones of the green algae *Blidingia* spp. and *Enteromorpha* spp. At mid-littoral levels *Fucus spiralis* and *F. vesiculosus* covered a ground layer of small green, brown and red algae. In January 2001 *Ceramium deslongchampii* formed a distinct zone a mid-littoral levels on the lower parts of river walls and *Aglaothamnion hookeri* (Dillwyn) Maggs & Hommersand was recorded for the first time. The flora remained otherwise more or less the same as that recorded twenty-five years earlier. Reappraisal of the vegetation on the sloping sea wall at Greenhithe also revealed in 1992 a similar vegetation to that recorded sixteen years before but with additionally an underflora of *Polysiphonia stricta* (Dillwyn) Greville and *Ectocarpus siliculosus* (Dillwyn) Lyngbye. Both species have spread further into the river as has *Elachista fucicola* (Velley) Areschoug, an obligate epiphyte on *Fucus*. The previously identified limit of *E. fucicola* was 6.5 km to the east. Brodie (1998) presented further evidence in support of upriver migration with the discovery in 1997 of *Porphyra purpurea* (Roth) C. Agardh at Greenhithe (7 km from its previously known limit). Reassessment of the site in January 2001 failed to reveal *P. stricta* and *P. purpurea*. A LNHS herbarium specimen, now at **BM**, of *F. vesiculosus* collected at Stone (near Greenhithe) in 1939 suggests that a population had been present there for some time (assuming that the specimen was attached and not drift). At Erith (7.5 km west of Greenhithe) the algal vegetation in January 2001 was much as in 1976. River wall rocks were covered by green algae at upper-littoral levels and by a dense canopy of *F. vesiculosus* at mid-littoral levels; the red alga *Audouinella purpurea* (Lightfoot) Woelkerling grew abundantly in shade beneath a jetty.

Eugeniou (1993) showed upriver migration of *Fucus vesiculosus* from Belvedere to Woolwich further into the middle reach of the Thames. At Crossness (3 km west of Belvedere) a dense canopy of large fertile *F. vesiculosus* plants now grows extensively on sea walls where in 1976 it had been absent (Figure 3). Occasional small and fertile plants had also spread to steps and slipways further west at Tripcock Ness (Figure 4). In January 2001 a population of small, sterile, *F. vesiculosus* grew on a slipway at Thamesmead. A few small, juvenile, *Fucus* plants were recorded in 1992 at Woolwich, its maximum upriver penetration. The salinity at Woolwich is low (7 g/l) compared with Belvedere, the 1976 limit of *F. vesiculosus*, where it averages 16 g/l. The species was not evident at Woolwich in January 2001. Although the algal vegetation at Woolwich was characterized by green algae, *Audouinella purpurea* formed a distinct zone in shaded situations at high tide level. Another red alga, *Polysiphonia stricta*, was found there for the first time in January 2001, growing in a moist niche at mid-littoral level on an east-facing wall. Its previous upriver limit was 15 km to the east at Greenhithe. *P. stricta* grew together with the filamentous diatoms *Hydrosera triquetra* Wallich and *Meloseira nummuloides* (Dillwyn) C. Agardh.

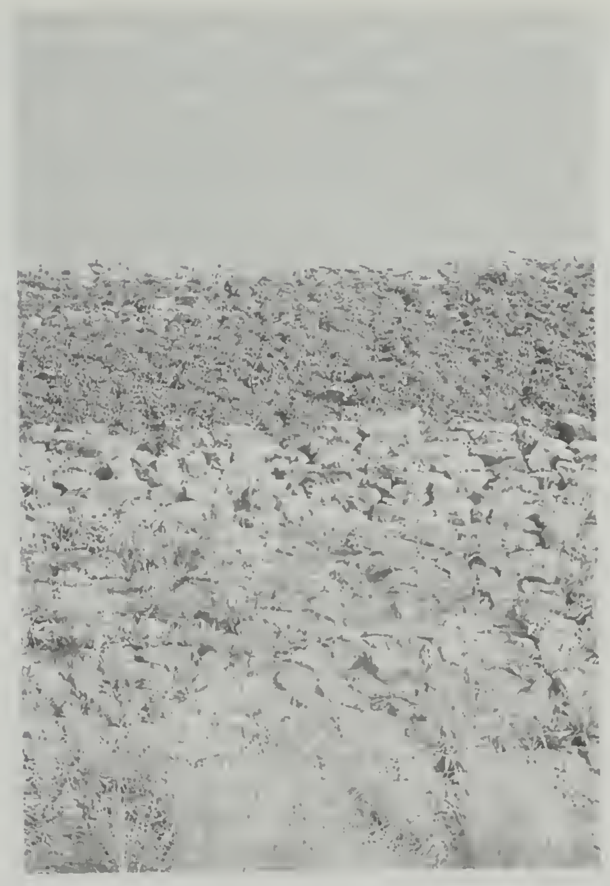

FIGURE 3. *Fucus vesiculosus* zone on lower parts of river wall at Crossness.

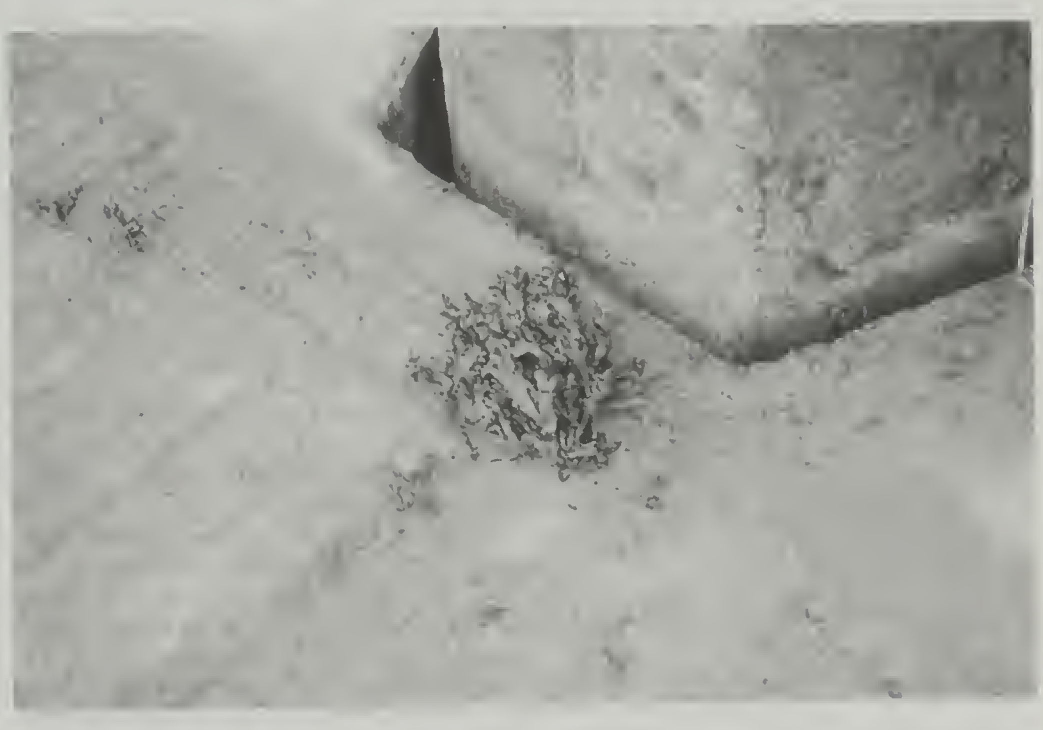

FIGURE 4. *Fucus vesiculosus* on a slipway at Tripcock Ness.

Zonal and seasonal changes were investigated on the river wall at Woolwich (Tittley 1985). The study revealed the die-back of an *Enteromorpha* cover and its replacement initially by a mucilaginous diatom-dominated community, trapping and binding silt. Subsequently blue-green algae, the unicellular red alga *Porphyridium purpureum* (Bory de Saint Vincent) Drew & Ross, and *Vaucheria compacta* appeared on and in the mat of trapped silt. Although the intertwining filaments of *V. compacta* provided stability to the mat, it eventually sloughed off revealing a bare surface which was recolonized by *Enteromorpha* spp.

The effect of shade on algal communities caused by jetties and other structures was investigated in greater detail between Woolwich and Wapping (Cox and Tittley 2000). Twelve species were recorded in this survey, including the red alga *Bangia fuscopurpurea* (Roth) C. Agardh for the first time in this section of the Thames. Algal communities were characterized in insolated situations by green algae, notably *Enteromorpha* spp. In shade (e.g. beneath a jetty at Charlton) the red alga *Audouinella purpurea* formed a distinct zone at high tide level. At Wapping, by contrast, a mat of diatoms covered a shaded river wall beneath a jetty. Analysis of quantitative data suggested an association of the green alga *Rhizoclonium tortuosum* (Dillwyn) Kützing with low light conditions.

An algal survey was also undertaken in Deptford Creek (Tittley and Cox 1997, 1999) as part of a maritime environmental restoration project (Steele 1999). The creek is a tidal tributary that forms the confluence of the River Ravensbourne and the Thames. Ten species of macro-algae were recorded from creek walls, and the vegetation was characterized by green algae typical of the middle tidal Thames. Algal cover was distinctly zoned relative to tide level with *Enteromorpha* spp. dominant on porous wood or brick substrata.

In the inner, limnetic, reach of the tidal Thames (Putney to Teddington), algal composition, seasonality and distribution were investigated by John et al. (1990). As in 1976, the algal vegetation was characterized by freshwater and a few euryhaline species. The algae of the River Wandle (a south-bank tributary that enters the tidal river near Wandsworth) were described by Price and Price (1983) and differed little from those inhabiting the limnetic section of the tidal Thames.

Tittley and John (1998) used a numerical method (TWINSPAN) to analyse presence-absence data for forty-five species at thirty-six sites along the tidal Thames, and test the validity of the previously defined sections of Tittley and Price (1977). Two main groups of sites were revealed, outer sites to Greenwich, and inner sites from London to Barnes (Figure 1). This suggested two principal floristic divisions in the estuary. The former division (A in Figure 1) could be further divided into a section containing species-richer mainly outer sites to Gravesend (C in Figure 1), and a section (D) containing species-poorer sites from Gravesend to Greenwich.

Discussion and conclusions

The earliest algal records for the middle tidal Thames are of species such as *Enteromorpha compressa*, *E. intestinalis* and *Vaucheria compacta* that are still common on river walls. The presumed continuous presence since the early nineteenth century of *E. intestinalis* and *Fucus vesiculosus* at Gravesend in the lower reach suggests long-term stability of the communities they characterize. Similarly, at Sheerness in the outer estuary *Porphyra umbilicalis* still grows on wooden groynes, and *Ceramium nodulosum* on erratic boulders. *Gloiosiphonia capillaris*, in contrast, has not been found since Hudson (1778), perhaps due to the ephemeral nature of this species.

The few records from the seventeenth to the early nineteenth century showed some species (mainly brown and red algae) to have been restricted to the mouth of the estuary. Others (e.g. *Fucus vesiculosus*) occurred further in, and yet others (principally green algae) were widespread in the tidal river. This is a pattern typical of estuaries and seen in today's Thames (Wilkinson 1980, Tittley and John 1998). The algal flora above the old London Bridge was, to speculate in the absence of firm records, similar to that now in the tidal limnetic section of the river.

Very little natural embankment and associated saltmarsh (and algal communities) remain in the Thames estuary and man-made structures now provide the principal intertidal and some subtidal habitats. These new substrata have been extensively colonized by macro-marine algae, bringing about a major change in marine flora. The diversity in form of man-made structures and the materials used in construction present probably a wider range of habitats for algal colonization than was previously available. The creation of shaded habitats on river walls beneath jetties in the Thames that resemble caves on the open coast is an example of a man-made feature and consequent species assemblage unlikely to have occurred in the tidal river's former natural state. A rocky shore environment, colonized by species that do not usually grow in saltmarshes, has replaced a soft-sediment marshy environment for which early data indicate the marine flora to have been characterized by Chlorophyta and *Vaucheria* spp. The change in coastal habitat has probably caused the local extinction of *Vaucheria dichotoma* which has not been recorded since the eighteenth century. The lack of herbarium records of the saltmarsh red algae *Bostrychia scorpioides* (Hudson) Kützing and *Catenella caespitosa* (Withering) L. Irvine has hindered recognition of other possible extinctions from the tidal Thames.

The absence of herbarium records and other algal data for the nineteenth and early twentieth centuries has also hindered understanding of the effect of chronic pollution on the marine algal flora of the tidal Thames.

Comparison of old and modern algal records suggest less change in the marine flora of the outer estuary where there remains a greater diversity of species. A not-unexpected exception is the spread of *Ascophyllum nodosum* to sea-walls there, since it has also spread to such structures throughout the southern North Sea. Studies since 1976 have shown the middle estuary to be a dynamic ecosystem. Both short-term (seasonal) and medium-term (migrational) changes have been recorded. Snelgrove and Wilkinson (1998) reported an upriver migration of *Fucus* in the River Tees following pollution abatement, and used *in situ* seaweed bioassays to predict incipient changes in pollution-damaged estuarine algal floras. Eugeniou (1993) suggested the migration of *Fucus* in the Thames might reflect the evolution of a strain tolerant to changes in salinity. The discovery of *Polysiphonia stricta* at Woolwich represents a considerable upriver spread of the species to a region of lower salinity. However, *P. stricta* grows in areas of comparable salinity (7–8 g/l) in the Baltic Sea (Nielsen et al. 1995). Maggs and Hommersand (1993) noted that although Thames (see comment in Tittley and John 1998: 57) and other populations resemble *P. subtilissima* Montagne, they may be an environmentally influenced form resulting from growth in low salinity conditions. Algal migrations upriver in the tidal Thames are probably due to availability of new habitat, and an increase in salinity coupled with a continued improvement in water quality.

Data analyses indicated the most strongly contrasting algal floras of the Thames to be in the freshwater and fully marine reaches and is typical of estuaries generally (Wilkinson 1980). The flora of the middle brackish reach is defined more by the absence of species and is an impoverished marine flora. Suggested sectional boundaries in this area are probably dynamic reflecting oscillations of salinity conditions and species distributions as exemplified by the failure of *Fucus vesiculosus* to establish a population at Woolwich, and the recent occurrence there of *Polysiphonia stricta* which, to speculate, may also be temporary.

The widely accepted forecasts of global warming and associated rise in sea level (0.6 m by 2100), the continued sinking of south-east England (0.3 m per century), and sporadic storm surges (Braine 2000) have potential consequences for the tidal Thames. These include increased tidal range and flooding with sea defences breached, further loss of riparian saline wetland and coastal erosion, upstream intrusion of salt-water wedges, and the retreat of the fresh/brackish water boundary (McIntyre 1998, Braine 2000). The Thames may become more marine in nature with additional species spreading into the estuary from the North Sea.

In contrast to past encroachment, the urban Thames river landscape in the twenty-first century is likely to be based on sympathetic as well as effective riverside design that will enhance its ecology and even achieve habitat restoration. An innovative example (cf. Anon. 1999) is on the Greenwich peninsula where flood defences have been moved back to create additional intertidal habitat. Terraces at successively lower tide levels have been built and saltmarsh communities planted; an associated algal assemblage will likely follow naturally.

In order to measure and assess future floristic change or stasis, there is a requirement for routine monitoring and recording. The qualitative data available to date have been useful for assessing the gross changes resulting from major habitat alteration, changes in distributional range, and identification of floristic divisions in the Thames Estuary. Middleboe and Sand-Jensen (2000) studied long-term changes in macroalgal communities in a Danish estuary. They noted that '. . . long-term changes in the abiotic environment and biotic components of ecosystems are often difficult or impossible to establish because old, baseline studies are either lacking or purely qualitative, preventing robust statistical evaluation of comparative data . . .'. Future time-series monitoring in the Thames (especially in relation to water quality) should therefore aim at acquiring quantitative data at reference sites; qualitative data remain useful for assessing broad floristic features and species distribution.

Field data should be supported by collections to provide a vouched historical specimen record. Such collections are authentic records in space and time and of value in assessing environmental change (Huxley and Bryant 1998). The absence of macro-algal collections and the general lack of information on the marine flora of the Thames for the late nineteenth and early twentieth centuries prevented reliable time-series comparisons for a critical period in the tidal river's history. Despite this, changes in the marine algal flora of the tidal Thames have been identified, and man's impact in influencing or causing such change has been significant; natural events such as isostatic readjustment and increase in salinity also play a role. The comprehensive body of baseline information now assembled (as specimens and published and unpublished data) will usefully support future studies on changes in the marine algal flora of the tidal Thames.

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Report of the second London ladybird survey, 1999–2000

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Synopsis 147
Introduction 147
Nomenclature 147
The aims of the survey 147
Baseline data 149
Records for 2000 150
Notes on some species 152
Conclusion 155
Acknowledgements 155
References 155

Synopsis

The records from the second year of the second London ladybird survey are summarized and the aims of the survey reiterated. Abundances in 2000 seem to have remained at, or declined from, the low levels of the previous year except for mycetophagous and phytophagous species. There has been a good level of participation and the survey could usefully continue for several years.

Introduction

The first survey of London's ladybirds took place over thirty years ago (Hall 1969, 1970). The first year of the second London ladybird survey was reported (Mabbott 2000*a*) with notes on the British list and the nature of recording. In the second year, there was an increased number of observers: a hundred and one are on the list of contributors although some of these are outside of the London Area. Fifty-six people contributed positive records for the London Area this year (forty-six in 1999) whilst a further ten people made regular observations but saw no ladybirds (four in 1999). This report reiterates the aims of the survey, assesses 'baseline' abundances, summarizes the findings of the first two years and considers relevant information on a few species in some detail. It is noted that, because of late receipt of records, the data published in the 1999 report, particularly Table 1, are incorrect. For this and other reasons, future reports will be produced less frequently.

Nomenclature

For such a small family, species and genera of the Coccinellidae are subject to considerable variation of naming. For brevity in this and other reports, the common English names are used in the text but the scientific names as published in Majerus and Kearns (1989) are included in Table 2. These have been superseded and in future the nomenclature in Hawkins (2000) will be followed.

The aims of the survey

These were considered before inception of the survey but are worth reiterating in this journal. Whereas the first London ladybird survey had the single aim of mapping the distribution of some ladybird species (Hall 1968), this second survey might analyse other phenomena.

Distribution of species. The two years of the survey have produced records from 242 tetrads in the London Area; older records are available from a further

215 tetrads. This suggests that a reasonable provisional distribution might be mapped within a few years. The location of the less common species may be useful in conservation planning.

Geographical distribution of pattern variants. Distribution of atypical elytral patterns may contribute to understanding the ecology of local populations. Over the two years there have been twenty-eight records of melanic 2-spots (constituting about two per cent of individuals) with other pattern variants around half of one per cent. Each year one variant of each of the hieroglyphic, 10-spot and 24-spot has been recorded. These numbers are too small for useful analysis yet. An incidental value of examining pattern variants links to the next section: Jones (2000*a*), in reporting finds of the 24-spot ladybird which have no spots, points out the possibility of overlooking the spotless species *Cynegetis impunctata*, present in France and a potential colonist. Clearly any all-red ladybird should be examined by an expert.

Colonization and dispersal of exotic species. Numerous species from Continental Europe fly haphazardly to the British Isles and are recorded; very few succeed in colonization, the bryony ladybird being the most recent exception. Other species are accidentally introduced (on food or other produce) from further afield which, in most cases, stand no chance of colonizing since climatic factors are wrong or their prey is unavailable. A third group of species are introduced intentionally for pest control: these are mainly for indoor culture although *Delphastus pusillus* has been licensed at least once for outdoor control of whitefly. Perhaps the final category is of most interest since prey necessarily is available and if species from similar climatic zones are employed, species might establish in competition with natives. Recognition of all these species and monitoring their colonization or extinction would be useful and observers in this survey might contribute valuable information. However, survey members have noted none to date.

An example of an accidental introduction occurred with the Australian *Rhyzobius lopanthae*, a predator of scale insects, found in Morden Park in 1999 by D. A. Coleman and identified by Roger Booth. This was presumed to derive from a nearby garden centre. Introductions from such subtropical areas are unlikely to survive. Failure to colonize would also be expected of species which are employed in greenhouse horticulture. However, the species most widely used in control of mealybugs *Cryptolaemus montrouzieri* has been found outdoors (Constantine and Majerus 1994) while Halstead (1999) noted an outdoor colony at Wisley from 1997 to 1999 in which larvae survived extensive periods of frost. If the climate of the London Area becomes warmer, such escapes might establish. On the European mainland, other species from temperate parts of the world have been used including the American *Hippodamia convergens* and *Coleomegilla maculata*. These and accidental or natural European introductions (Majerus and Kearns 1989, Muggleton 1999) would have suitable prey available and need little adaptation to the climate. The larger ladybirds should be easily recognized although they are not covered by current keys.

Majerus (1997*b*) has pointed out the impact that exotic ladybirds might have on the native fauna and noted that *Coccinella septempunctata* (imported from Europe) and *Harmonia axyridis* (imported from Asia) are now the two most commonly recorded ladybirds in the USA. *H. axyridis* can, apparently, be obtained from France by anyone with a credit card and an internet connection.

Phenology of species. The life history of the less common species has not been clearly elucidated. Amongst the more common species, the regularity and fate of second (or third) generations is debatable. The orange ladybird can overwinter in early life stages. The survey might contribute useful information on this, particularly the effect of changing weather patterns.

Habitat and prey affinity. Hawkins (2000) has noted the change of prey of the pine ladybird to new scale insects and the apparent adaptation of the 24-spot to false oat-grass *Arrhenatherum elatius* from herbs (Baldwin 1988, 1990). The normally mycetophagous orange ladybird was observed, on the Isle of Man, feeding on aphids (Luff et al. 2001). The Coccinellidae are clearly adaptable and other changes of prey can be anticipated. Most recorders note plants on which ladybirds are observed so data are accumulating for future analysis. Of course, most ladybirds prey on homopterans, especially aphids, so many plant associations are indirect. However, it seems likely that the 7-spot and some other species actively select certain plants on which to lay eggs even in the absence of aphids (Schaller and Nentwig 2000). For this reason the observations may extend knowledge of plant associations.

Other aspects of population ecology. Population response of ladybirds to weather and, perhaps, climate change should be discernible. Other factors, for instance disease or pollution, might be less obvious but worth consideration. Some species, notably the orange and pine, have become increasingly common over recent decades while others, such as the 11-spot, seem to have diminished in numbers and range. Population changes are best considered for each species individually. For this purpose, those records from sites which are examined at regular intervals over several years will be most useful.

Baseline data

It is not possible to consider increase or decrease of population without knowing the ‘normal’ population range over several years. A reasonable time series of records will produce its own average level but unfortunately this survey started during a period of patently low population levels. Table 1 lists four data sets, which may indicate relative abundances of ladybird species. Each set has advantages and disadvantages. All are based on numbers of individuals reported rather than site-date records as largely employed in this survey.

TABLE 1. Coccinellid records from previous studies.

Species	**London 1968–9**		**Surrey 1980–99**		**N.E. London 1993–6**		**Leyton 1997(ii–vii)**	
	no.	%	no.	%	no.	%	no.	%
16-spot			28,500	54.2	27	9.3		
Pine			5,450	10.4	5	1.7	19	2.2
7-spot	135	12.0	4,980	9.5	85	29.4	353	41.4
2-spot	889	79.1	3,715	7.1	40	13.8	445	52.2
24-spot			2,769	5.3	37	12.8		
14-spot	33	2.9	1,370	2.6	39	13.5	21	2.5
22-spot	27	2.4	1,222	2.3	27	9.3	7	0.8
Kidney-spot			1,183	2.3				
Rhyzobius litura			918	1.7	2	0.7		
10-spot	31	2.8	842	1.6	5	1.7	7	0.8
Orange			470	0.9				
Cream-spot			369	0.7	8	2.8		
Cream-streaked			318	0.6				
Water			227	0.4				
Eyed			186	0.4				
Adonis’			86	0.2	13	4.5		
Hieroglyphic			<90	<0.2	1	0.3		
11-spot	9	0.8	41	0.1				
Total	1,024		52,519		289		852	

The first set (London 1968–9) is that published for the first London ladybird survey (Hall 1970) which concerned itself with only six species. The second (Surrey 1980–9) selects some of the data of Hawkins (2000) from his massive Surrey survey. This should be the closest representation to abundances for the whole of the London Area, however, there are some confusing factors such as the inclusion of *Rhyzobius litura* and other small coccinellids which will largely be overlooked in the current survey (see below). There is relative over-recording of the 16-spot ladybird which is often found in huge aggregations leading observers to report the numbers involved whereas non-aggregating species are merely reported as 'present' even when, as with the 24-spot ladybird, they may be present in similar or greater numbers, often in the same habitat. The third column (NE London 1993–6) lists my records incidental to other studies, predominantly in the north-east of the London Area, and thus presents a small, haphazard sample of a variety of common habitats; the selection of species is strongly biased by the nature of the sampling (mainly by pitfall traps) towards ground-active species. The final column lists my naked-eye observations over six months (February to July) in 1997 in a cluster of three small urban sites in Leyton, E10 (a domestic garden, an allotment and a school's created nature area) in which the ladybirds were counted twice weekly. This study was very brief and local; over-recording (by counting the same individual more than once) is likely. Nonetheless, the figures are perhaps those most likely to resemble survey records from urban gardens, parks and similar sites; furthermore, 1997 was the last 'good' year for ladybirds before the sharp decline in spring 1998.

The proportion of any species as a percentage of all ladybirds (as given in Tables 1 and 2) is of limited value other than providing a sort of league table. However there is actually some correlation between annual variations of different species; that is, abundances of various species tend to rise and fall together. For instance, Owen (1991) provides histograms of abundances of several species caught in a Malaise trap over fifteen years in which there is considerable correlation between the peaks and troughs of 2-spot, 7-spot, 11-spot and 14-spot ladybirds although with differences of degree. The 7-spot seems particularly prone to extreme fluctuations. Proportions of species vary geographically, presumably in reaction to the local climate. In Owen's Leicester set, the 14-spot was the second most frequently trapped species as it was in Oxford, where it was found more often than the 2-spot (Losito 1984). Similar variations might be expected over the London Area.

Records for 2000

Table 2 lists all records from 1999 and 2000 expressed as numbers of records, percentages of all records and mean individual numbers per record. The last figure is perhaps meaningless for the orange ladybird due to the occurrence of three very large aggregations. It should be noted that the 1999 data differ considerably from that published last year due to late receipt of some records. Unlike the previous summary, this one lists the 'non-ladybird' coccinellids. Over the two years, all of the likely twenty-three large British ladybirds along with thirteen smaller species have been recorded. Caution must be applied to interpreting this list especially since most species are represented by only small numbers of records and individuals. It is not yet feasible to analyse patterns amongst the least common species. The numbers of records show a modest increase for many species but this is deceptive since the number of recorders has increased considerably (forty-six to fifty-six), therefore species records might have been expected to increase by about twenty per cent over the previous year. This is a simplistic view since increased recording effort might result in non-linear increase of records and also because there is no assurance that the sites reported are the same year on year. These, and other, factors need to be taken into account for long-term analysis. Nevertheless, it may be worth considering data adjusted on this basis as a rough indicator of regional population change. Table 3 presents such adjustments for the eleven species that have been recorded more than twenty-five times (over two years) during this survey (the total numbers for each species over the two years are also noted). The table uses the numbers of records expected in 2000 if these had increased in proportion to the extra recording effort (multiplying by 56/46) and expresses the calculated increase or decrease as a percentage of the numbers for the earlier year. These figures suggest a real increase in the numbers of all mycetophagous (orange, 22-spot, 16-spot) and phytophagous species (24-spot, bryony) but a decline of all aphidophagous species except for the 7-spot. These and untabulated data on individual abundances are included in comment on some species of note below.

TABLE 2. All coccinellid species reported during 1999 and 2000.

		Records		**Percentage of all records**		**Individuals (mean)**	
Species		**2000**	**1999**	**2000**	**1999**	**2000**	**1999**
Adalia bipunctata	2-spot	173	155	21.8	24.8	3	5
Coccinella septempunctata	7-spot	126	100	15.9	16.0	3	2
Halyzia sedecimguttata	Orange	102	46	12.9	7.3	34	32
Psyllobora vigintiduopunctata	22-spot	101	59	12.7	9.4	2	1
Subcoccinella vigintiquattuorpunctata	24-spot	46	26	5.8	4.2	4	1
Adalia decempunctata	10-spot	38	49	4.8	7.8	3	2
Propylea quattuordecimpunctata	14-spot	35	49	4.4	7.8	1	1
Exochomus quadripustulatus	Pine	29	37	3.7	5.9	3	4
Calvia quattuordecimguttata	Cream-spot	24	27	3.0	4.3	1	2
Tytthaspis sedecimpunctata	16-spot	22	12	2.8	1.9	2	1
Chilocorus renipustulatus	Kidney-spot	18	5	2.3	0.8	4	2
Henosepilachna argus	Bryony	15	5	1.9	0.8	9	6
Adonia variegata	Adonis'	14	9	1.8	1.4	1	12
Rhyzobius litura		14	14	1.8	2.2	1	1
Harmonia quadripunctata	Cream-streaked	6	3	<1.0	<1.0	3	2
Anisosticta novemdecimpunctata	Water	6	2	<1.0	<1.0	3	5
Coccidula rufa		6	1	<1.0	<1.0	1	1
Coccinella hieroglyphica	Hieroglyphic	4	1	<1.0	<1.0	1	1
Scymnus suturalis		3	2	<1.0	<1.0	1	1
Chilocorus bipustulatus	Heather	2		<1.0	<1.0	2	
Nephus quadrimaculatus		2		<1.0	<1.0	1	
Rhyzobius chrysomeloides		2		<1.0	<1.0	2	
Anatis ocellata	Eyed	2	3	<1.0	<1.0	6	1
Myrrha octodecimguttata	18-spot	1	4	<1.0	<1.0	1	1
Platynaspis luteorubra		1		<1.0	<1.0	1	
Scymnus auritus		1		<1.0	<1.0	1	
Aphidecta obliterata	Larch	1	3	<1.0	<1.0	4	1
Clitostethus arcuatus			4		<1.0		1
Coccidula scutellata			1		<1.0		1
Coccinella magnifica	Scarce 7-spot		1		<1.0		1
Coccinella undecimpunctata	11-spot		2		<1.0		6
Nephus redtenbacheri			1		<1.0		1
Rhyzobius lopanthae			1		<1.0		1
Scymnus haemorroidalis			1		<1.0		1
Stethorus punctillum			3		<1.0		1
Total		794	626				

TABLE 3. Changes of frequency of common ladybirds, adjusted for recording effort.

Species	Increase as percentage of 1999	Total records 1999 and 2000
Halyzia sedecimguttata	100.0	148
Tytthaspis sedecimpunctata	61.6	34
Subcoccinella vigintiquattuorpunctata	55.2	72
Psyllobora vigintiduopunctata	49.5	160
Coccinella septempunctata	4.3	226
Adalia bipunctata	–10.1	328
Rhyzobius litura	–21.7	28
Calvia quattuordecimguttata	–32.9	51
Exochomus quadripustulatus	–43.4	66
Adalia decempunctata	–44.2	87
Propylea quattuordecimpunctata	–50.3	84

See text for calculation.

It is likely that the weather, directly or indirectly (through reduction of prey) is responsible for low levels of predatory species. This may be clarified when a long time sequence can be compared with weather data. Correlation with abundances of prey and similar predatory species (such as lacewings and hoverflies) might be possible.

Notes on some species

7-spot. *Coccinella septempunctata* is considered the most common species nationally and in most years is certainly the most widespread although often less abundant than the 2-spot in urban areas. The contribution of 17–18 per cent of all records for this survey is lower than all of the baseline figures considered above except for that of the first London ladybird survey. In this regard, it is notable that the latter survey recorded only seven 7-spots in 1968 (1.7 per cent of all individuals). Clearly the 7-spot has years of serious decline as well as years of great abundance (such as those considered by Burton 1998 and Majerus and Majerus 1996). The 7-spot emerges from hibernation before most other species and is thus likely to suffer from spring frosts both directly and through absence of aphid prey. It is also the species most prone to parasitism by the braconid *Dinocampus coccinellae* (Geoghegan et al. 1997, Majerus 1997*a*).

2-spot. *Adalia bipunctata* is the most recorded species in this survey as would be expected: it has a preference for urban areas as clearly demonstrated by Hawkins (2000) and is the most commonly seen ladybird in gardens. The data suggest a relatively low population in 1999 may have fallen in 2000: whereas 680 individuals were reported in the former year, only 242 were noted during 2000 despite an increase in the number of recorders. The 2-spot is not parasitized by *Dinocampus coccinellae* although other parasites or diseases might be responsible for excessive mortality. Majerus (1997*b*) summarizes the various predators, parasites and pathogens which afflict ladybirds. The species normally emerges from hibernation later than the 7-spot and thus many individuals should miss late frosts. Therefore the apparent decline in numbers is not easily explicable by the available data. However it is notable that during January and February 2001 (outside the period of this report) more than two hundred ladybirds, mainly 2-spots, have been reported entering houses, particularly upper storeys. This is not a new or unusual phenomenon but seems to be very widespread and early this winter. Such early activity, before prey is available and before the likelihood of frost has passed could account for mortality and reduced reproductive capacity. It also exemplifies the need to consider population changes over several years rather than by calendar dates.

Adonis'. *Adonia (Hippodamia) variegata* was considered a nationally notable beetle (Hyman and Parsons 1992) however it is not uncommon in the London Area. When seen, it is often present in large numbers as exemplified by Max Barclay's finding on waste ground in Fulham during 1999. It appears to survive by colonizing ruderal vegetation before other predatory species arrive and thus appears ephemeral. It is likely to turn up in gardens but both its numbers and its distribution in this survey are likely to be unstable.

11-spot. This ladybird was formerly not uncommon in the London Area (Benham 1969) but seems to have declined since the 1960s. Only nine records were made during the first London ladybird survey, most of which were close to the Thames or Lea (Hall 1970). Benham and Muggleton (1970) investigated the distribution and habits of the species and concluded that it was constrained by atmospheric humidity, preferring relatively dry areas, whereas Hawkins (2000) notes the low incidence of records following cold winters. The association with coastal areas noted in older entomological works (Joy 1932, Pope 1953) is therefore probably coincidental. In view of the recent mild winters a revival of abundance might have been expected although this effect might be obscured by heavy summer rainfall.

Pine. *Exochomus quadripustulatus* is expected to be one of the most common species in the London Area including urban parts where there are trees infested by various scale insects. Hawkins describes these associations in detail noting that the main prey in Surrey is *Pseudochermes fraxini* on ash but in urban areas the large scale *Pulvinaria regalis* on lime, sycamore, exotic maples and horse chestnut is the main food item. From being a fairly uncommon and predominantly rural species this has become an abundant and widespread one. Large numbers are often seen on individual trees. The relatively small numbers recorded in this survey are probably due to under-recording: most participants observing herbs and grass while the pine ladybird is found overwhelmingly on the trunks and branches of trees. Another consideration is that it is being interpreted as a melanic 2-spot although this seems unlikely from the number of melanics recorded. A third possibility is that there has recently been a decline in numbers: the pine emerges very early in the spring and might be susceptible to frosts although these seem to have had no effect on scale insects.

Data from entomologists who actively examine trees suggest that there has been no real decline. Early records for 2001 note large numbers present from the winter (Hawkins, Devos pers. comm.). If this distinctive (if somewhat cryptic) and abundant species is under-recorded, it is likely that the other, less common, arboreal species (especially the striped, cream-streaked, larch and 18-spot) are also under-represented.

Orange. The large aggregations of *Halyzia sedecimguttata* in Epping Forest during 1999 and 2000 were noted in this journal (Mabbott 2000*a*) and elsewhere (Dagley 2000, Hill 2000, Mabbott 2000*b*). Other reports occurred at the same time (Everett 2000, Jones 2000*b*, Lane and Plant 2000). During 2000 there were an increased number of reports (Tables 2 and 3) but the only large aggregation outside Epping Forest was of more than 500 individuals reported by Seth Gibson from Epsom Common in November–December 2000. Most records were from beech but the Epsom records were mainly on ash which appears to be the second most common host, after sycamore, in Surrey. The beetle was also observed on oak, birch and, very rarely, sycamore (formerly the most common host: Majerus and Williams 1989). Some records this year have come from trees away from woods and many at light traps. It is not infrequently taken at lepidopterists' mv traps but numbers have increased this year: Ray

Softly caught his first two after many years of trapping in Hampstead; while John Muggleton trapped thirty-two in Staines over twenty-two nights compared to four over four occasions in 1999. The light-trapping data show a May–September distribution with peak flight during July and August. This contrasts with the findings of large aggregations on trees from November to March. Orange ladybirds are frequently taken at light but they are not the only ladybirds trapped, nor the most numerous (Owen and Dacie 1997) so the recent surge of records is probably significant. Aerial trap results are useful as indications of migration but, of course, do not signify residence.

There is also the paradox that catches may be higher during years in which conditions are unfavourable. Thus Owen (1983) caught much larger numbers of mycetophagous 22-spot ladybirds in a Malaise trap during the drought year of 1976 than in the subsequent nine years. However, lack of food does not seem to be the cause of high activity in this survey. There has been speculation (Allen 1997, Birkett 2001) as to whether the species is prone to mass, long distance migrations; the present results are compatible with steady local dispersal from centres of high abundance.

Uniquely amongst British ladybirds, the species has been known to overwinter as pupae (Majerus and Williams 1989, Majerus 1992) while larvae are active until late in the year and might possibly survive into mild winters. These might contribute to the large numbers seen in early spring but early life stages have not yet been observed during winter in this study.

22-spot. Like the orange ladybird, *Psyllobora vigintiduopunctata* is a mildew-feeder; however it lives on fungi at ground level rather than in trees and thus is more widely dispersed and more likely to be detected by observers in this survey. The records indicate a modest increase in numbers over the year. Most observations were of two individuals, most of them mating. As with the orange, the cool, wet weather would cause no depletion of food supply but, living on open land, it is more susceptible to deleterious weather effects although, to some extent, this may be mitigated by its late date of emergence.

Bryony. *Henosepilachna (Epilachna) argus* was discovered first in this country by Ian Menzies' grand-daughter, Alysia, in West Molesey, Surrey in 1997 (Menzies and Spooner 2000). It has subsequently spread to surrounding areas, having been found in sixteen Surrey tetrads. It was found north of the Thames at Kempton Park by James Ranger in 1999 and 2000; also in 2000 it was observed in Bushey and Hampton Court Parks. The species is a herbivore and has been found on many plants although only seen to eat leaves of white bryony. In Europe it is known to feed on other members of the Cucurbitaceae such as courgettes and thus has the potential to become a pest although there is no suggestion of this at present. The species is not covered by Majerus and Kearns (1989) but fully described and illustrated by Menzies and Spooner (2000) and by Hawkins (2000). It is similar to the 24-spot ladybird but larger (6–8 mm) with twenty-two black elytral spots on a uniformly dull red background.

Hieroglyphic. There have been very few records of this distinctive species but most have been some distance from natural *Calluna* heath which is the habitat of its usual prey, the heather-leaf beetle *Lochmaea suturalis* (Majerus et al 1997, Majerus 1997*b*). The species may be highly mobile, it may have been translocated or it may have found an alternative food source in urban parks or gardens.

Eyed. Very few records of *Anatis ocellata* have been received, mainly from Dagenham where this year they were all dead, drowned during the summer rains. The species is distinctive and virtually confined to conifers. The recent records come from F. R. D. Linehan whose accounting for the number of conifers in Dagenham is worthy of another article. However the main significance of these finds is as a reminder that effects of weather are not confined to extremes of temperature: the heavy summer and autumn rainfall in 2000 may have caused unusual mortality especially in areas extensively flooded.

'Non-ladybird' Coccinellidae. This term seems to have been coined by Majerus for the Cambridge national ladybird survey to describe those coccinellids which because of their small size or atypical shape were not likely to be identified as ladybirds for that survey. The term 'atypical' seems less confusing and will be applied in future. Hawkins lists seventeen resident species for Surrey including *Rhyzobius chrysomeloides* which he has recently added to the British list (Hawkins 2001). Many of these species are considered rare or notable (Hyman and Parsons 1992) but in some cases this may reflect under-recording. These species are all unlikely to be recorded in the survey except by skilled entomologists.

Conclusion

The survey is producing valuable data which should improve our knowledge of the regional population dynamics and distribution of many species of Coccinellidae. The number of participants is increasing (at the time of writing, more than two hundred are listed) and their identifications seem unexceptionable. Initial findings suggest that the weather and consequent food availability are the primary causes of current population levels of the more common species. However, the data are sparse (due to the low population levels) and require detailed analysis over several years to unmask significant trends; there has been some delay in collating records and the life cycle of ladybirds extends over the calendric year end. It is therefore unhelpful to produce annual reports.

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Book reviews

***The flora of the Bristol region. Wildlife of the Bristol region:* 1.** Ian P. Green, Rupert J. Higgins, Clare Kitchen and Mark A. R. Kitchen. Edited by Sarah L. Myles. Pisces Publications, Newbury, 2000. 276 pp. £27.50. ISBN 1 874357 18 8.

The changing flora of Glasgow. Urban and rural plants through the centuries. J. H. Dickson, P. Macpherson and K. J. Watson. Edinburgh University Press, Edinburgh, 2000. 402 pp. £30. ISBN 0 7486 1397 8.

The editor of The *London Naturalist* encouraged me to review these two very different books on the basis of my name appearing frequently in the Glasgow one, yet for me the determining feature of the Bristol one is that my name does not appear in it at all, although I lived in the south-west corner of its area about forty years ago and was the first to record many of the rarer species in still extant sites.

The flora of the Bristol region is very much an atlas of current distributions, with dot-maps showing distribution by one-kilometre squares, a considerable undertaking which required an exceptionally large number of volunteers. There is a chapter on past botanists in the region, but it would have been better to publish it elsewhere, as it has no relevance to the work in hand; there is no link between the older records mentioned in it, e.g. Charles Alden's find of *Limosella aquatica* on Siston Common, and the main text of the flora. A much more unusual and interesting feature is the chapter on sites of botanical interest, which describes nineteen of the sites in terms of what can be found there and conditions of public access. This follows an extremely comprehensive chapter on the habitats of 'the Bristol region'. This is not the same area as that of the famous 1912 *Bristol flora* of J.S. White, but is what was called the County of Avon at the time of the new flora's conception, so that it overlaps with the 1948 *Flora of Gloucestershire* and its 1986 supplement, but is co-terminous with the 1997 *Atlas flora of Somerset*, which also adopted a modern county boundary.

The changing flora of Glasgow is perfectly described by its title. Though there is a conventional middle section cataloguing past and present species, with tetrad distribution maps, what goes before and after is of outstanding interest. The section on the spread of the city is tellingly illustrated by eighteenth-century engravings, matched by modern views from the same spot. A chapter comparing the flora of Glasgow with that of other cities, especially London and Berlin, concludes that the urban flora is more or less universal and the differences between Glasgow and other cities can probably be put down to its relatively cold, moist climate. It is nice to see the chapter on implications for conservation placing proper emphasis on brownfield sites (though that term is not used) and aliens. Although Glasgow is a lot further than Bristol, London botanists have more to learn from the work of Prof. Dickson and his colleagues than from the Bristol team.

RODNEY BURTON

***The ground beetles of Northern Ireland* (Coleoptera-Carabidae).** Roy Anderson, Damian McFerran and Alastair Cameron. Ulster Museum, Belfast BT9 5AB. 246 pp., 64 colour plates. £14.99. ISBN 0 900761 37 7.

A book on beetles of Ireland seems an unlikely recommendation to readers of a London journal. Indeed, much of the fascinating ecological and distributional detail in this book will be of interest only to the most dedicated coleopterist. However, the fifty-six colour photographs make the volume extremely useful for the would-be student of ground beetles. A drawback of the book is the nomenclature which differs from the conventional British usage in specific names (e.g. *Leistus terminatus* rather than *L. rufescens*) and generic ones, thus *Agonum assimile* becomes *Platynus assimile* and *Ophonus rufibarbis* is used for *Harpalus rufibarbis*. This may be taxonomically correct but will confuse all but the expert; a list of synonyms should be included. Nonetheless, this book will be valuable for anyone recording carabids as well as providing detailed and up-to-date information on their wider distribution and ecology. The final section will be of interest to conservation planners and land managers.

PAUL MABBOTT

Collembola (springtails) of Brockham lime kilns, Box Hill

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Abstract 159
Introduction 159
Methods 159
Results 160
Discussion 164
Acknowledgements 164
References 164

Abstract

Twenty-four species of springtail were identified from habitats within the Brockham lime kilns reserve, Box Hill, Surrey. Samples were taken along a successional gradient from bare chalk rubble through scrub and grassland to secondary woodland. Both density and species richness of Collembola were found to be highest in the grassland area. The dataset includes the third UK record of *Folsomides parvulus*, a species thought to be associated with seasonally dry habitats and which was found here principally on stabilized chalk scree.

Introduction

Brockham lime kilns is a disused industrial site on the southern foot of Box Hill whose diverse calcicole vegetation has been described and classified by Shaw (1999). Chalk mining operations left large areas of bare chalk rubble, which have subsequently undergone natural recolonization with calcicole flora. Much of the interest of the site lies in the range of successional ages that can be encountered here, from bare chalk (in disturbed or unstable areas) to scrub woodland with an understorey of woodland herbs such as dog's mercury *Mercurialis perennis*. Papers about the conservation interest of disused quarries have tended to concentrate on their flora (Davis and Jones 1978, Usher 1979, Jefferson 1984, Ursic et al. 1997) rather than invertebrate fauna, even though the greatest biodiversity value of these sites may lie in their insects (Davis and Jones 1978).

The work described below consists of a study of successional changes at this site in a ubiquitous but rather neglected group of insects, the Collembola or springtails (Hopkin 1997). Recent work has shown clear evidence of post-fire successional changes in this group in heathland habitats in the London area (Shaw 1997). Much of the work that has been published on community succession in Collembola refers to work on minespoil (Davis and Jones 1978, Hutson 1980*a,b*, 1981, Parsons and Parkinson 1986, Moore and Luxton 1988) or other post-industrial wastes (Greenslade and Majer 1993). The only previous work studying Collembola of recolonizing quarries is Parr (1978), who found evidence of successional changes away from the working edge of a chalk quarry in Yorkshire.

The intentions of this work were to define the composition of the Collembola community in sites representing the full habitat range within the quarry, to examine whether there was evidence of successional changes within these communities, and to attempt to relate the community structure to environmental features.

Methods

The research was undertaken within the Brockham lime kilns nature reserve (Grid Reference TQ182511) during 1999. Soil samples were taken from four sites previously described as transects by Shaw (1999), who also attempted

NVC classifications. The 'Scree' site was loose scree at the western end of the quarry, corresponding to transect 5 (NVC category CG7c). The 'Scrub' site was loose spoil banks at the western end of the quarry, undergoing colonization by scrub and chalk grassland, and previously described as transect 3 (CG2a). The 'Grassland' site was short chalk grassland, corresponding to transect 6 (CG2a). The 'Woodland' site was secondary woodland dominated by *Acer psudoplatanus, Betula pendula, Cornus sanguinea, Crataegus monogyna* and *Salix* spp., previously described as transect 8 (W21d).

Soil samples were taken by trowel, approximating 20 cm diameter and 5 cm depth, and were returned in plastic bags to the University where soil arthropods were extracted into 5 per cent ethanol using a Tullgren apparatus. Identifications were performed using Hopkin (2000). Samples were collected on five dates (29.vi, 5.vii, 17.ix, 19.x.1999, and 3.ii.2000) and on each date two cores were removed from each of the four sites, making a total of forty soil cores. After extraction, soils were pooled and randomly subsampled for analyses on five replicate subsamples: data collected were pH (10 g dried soil: 25 ml distilled water) and percentage loss on ignition (400°C).

Software used for data analysis and ordination were SPSS 9 and PC-Ord 4.0 (MjM Software Design 1999). The significance of differences between sites were assessed using ANOVA for soil data (whose distribution approximated normality), but the non-parametric Kruskal-Wallis test for all Collembola data. Ordinations were performed on data transformed by $\log(x+1)$. PCA was used to assess overall patterns in the data, and CCA used to relate Collembola community data to soil data, using a Monte-Carlo test to examine the null hypothesis of no association between data sets. To avoid pseudoreplication (Hurlbert 1985) the CCA represented each of the four habitats as unreplicated multivariate observations.

Results

Twenty-four species of Collembola were recorded, listed in Table 1. These were all species described by Hopkin (2000) as common and widespread, except for *Folsomides parvulus* which has two previous UK records. Specimens assigned to the genus *Tullbergia* (small, white soil-dwelling forms) were not identified to species at the time of sorting so are recorded as *Tullbergia* spp., but reanalysis of archived samples showed that this operational taxonomic unit contained specimens of *Paratullbergia callipygos* (Börner) and *Mesophorura affinis* (Börner). Table 2 also summarizes the densities of each species, the number of records, and the significance of the differences between sites. Differences between dates were also tested, but of the twenty-three tests performed only one was significant ($p<0.05$). This concerned the common surface-active species *Entomobrya nivalis* which was recorded on the first three sampling dates but not on the final two.

The general trend was for density, richness and diversity to be lowest in the scree (where four samples held no Collembola at all), and highest in soils from the grassland area (Figures 1, 2 and 3). No species were confined to the scree, and only one *Folsomides parvulus* was commonest in the scrub.

Summary soil data are given in Table 2: both pH and organic matter content differed significantly between sites ($p<0.05$). These data show that soil organic matter increases while bulk soil pH decreases as succession proceeds.

Evidence of systematic patterning within the data was sought by Principal Components Analysis ordination, using $\log(X+1)$ – transformed data from the fourteen species found in five cores or more. The first two axes of this ordination accounted for 27.5 per cent and 13.7 per cent of the variance respectively.

Comparing these figures with variance allocations predicted by the broken stick heuristic for selecting principal axes (Jackson 1993) suggested that the first axis contained more information than would be expected in random noise while the second and higher axes did not. The ordination diagram for the first two principal axes is presented as Figure 4, showing the grassland samples to cluster separately from the woodland and scrub sites, which were not well separated. The scree samples form a tight cluster, reflecting the low degree of variation in their community (which was consistently depauperate).

Canonical Correspondence Analysis (ter Braak 1986) was used to explore whether there was a relationship between the Collembola and soil composition, but Monte-Carlo testing indicated that the pattern was non-significant.

TABLE 1. Summary data for Collembola in Brockham quarry.

Species	**Number of cores in which it occurred (out of 40)**	**Density m^{-2} mean ± se**	**Significance of site effect?**[1]
Brachystomella parvula (Schäffer)	9	68 ± 27	**
Cyphoderus albinos Nicolet	6	18 ± 8	**
Entomobrya nivalis (Linnaeus)	11	48 ± 21	NS
Folsomia quadrioculata (Tullberg)	3	84 ± 75	NS
Folsomides parvulus Stach	4	8 ± 4	NS
Friesea mirabilis (Tullberg)	14	74 ± 27	*
Hypogastrura purpurascens (Lubbock)	10	30 ± 11	NS
Isotomiella minor (Schäffer)	19	361 ± 179	**
Isotomodes productus (Axelson)	4	16 ± 11	**
Isotoma notabilis (Schäffer)	28	1,191± 354	**
Isotoma viridis (Bourlet)	12	78 ± 25	**
Lepidocyrtus curvicollis Bourlet	29	418 ± 81	**
Lepidocyrtus cyaneus Tullberg	2	3 ± 2	NS
Megalothorax minimus Willem	3	9 ± 6	**
Neanura muscorum (Templeton)	3	5 ± 3	NS
Orchessella cincta (Linnaeus)	4	8 ± 4	**
Pseudosinella alba (Packard)	1	3 ± 3	NS
Sminthurinus aureus (Lubbock)	7	29 ± 12	NS
Sminthurinus elegan (Fitch)	11	73 ± 30	**
Sphaeridia pumilis (Krausbauer)	11	86 ± 32	NS
'*Tullbergia* spp.' (see text for species)	13	46 ± 13	**
Tomocerus minor (Lubbock)	4	24 ± 15	**
Tomocerus longicornis (Müller)	6	19 ± 10	NS
Total Collembola	–	2,682 ± 544	**
Species richness per core		5.3± 0.5	**
Simpson's diversity	–	0.53 ±0.04	**

1: Abbreviations: NS – p> 0.05, *: P<0.05, ** P < 0.01

TABLE 2. Summary soil data for the four habitats sampled (mean ± S.E. of 5 replicates).

Habitat	**pH (Distilled water)**	**%LOI**
Scree	8.75 ± 0.06	1.7 ± 0.1
Scrub	8.64 ± 0.04	4.9 ± 0.7
Grassland	8.00 ± 0.03	10.8 ± 1.6
Woods	7.99 ± 0.03	11.9 ± 0.9

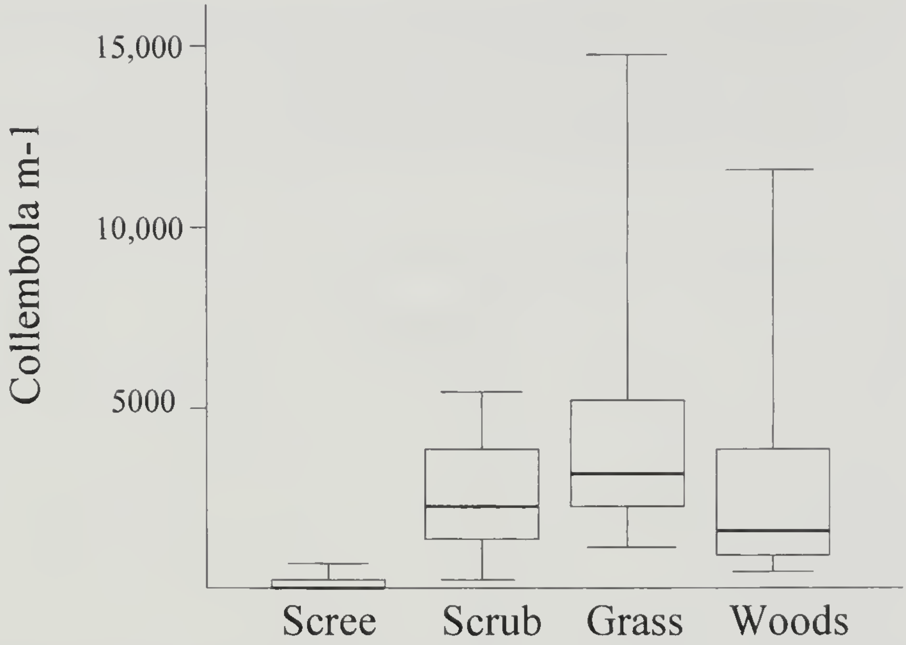

FIGURE 1. Boxplot showing total Collembola m^{-2} from each of the four habitats sampled in Brockham Quarry.

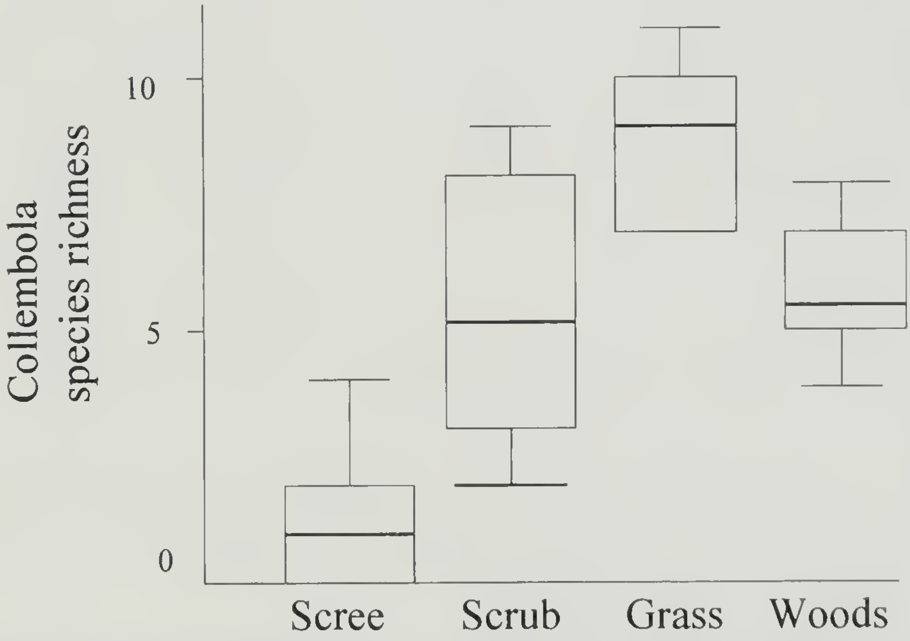

FIGURE 2. Boxplot showing species richness of soil cores from each of the four habitats sampled in Brockham Quarry.

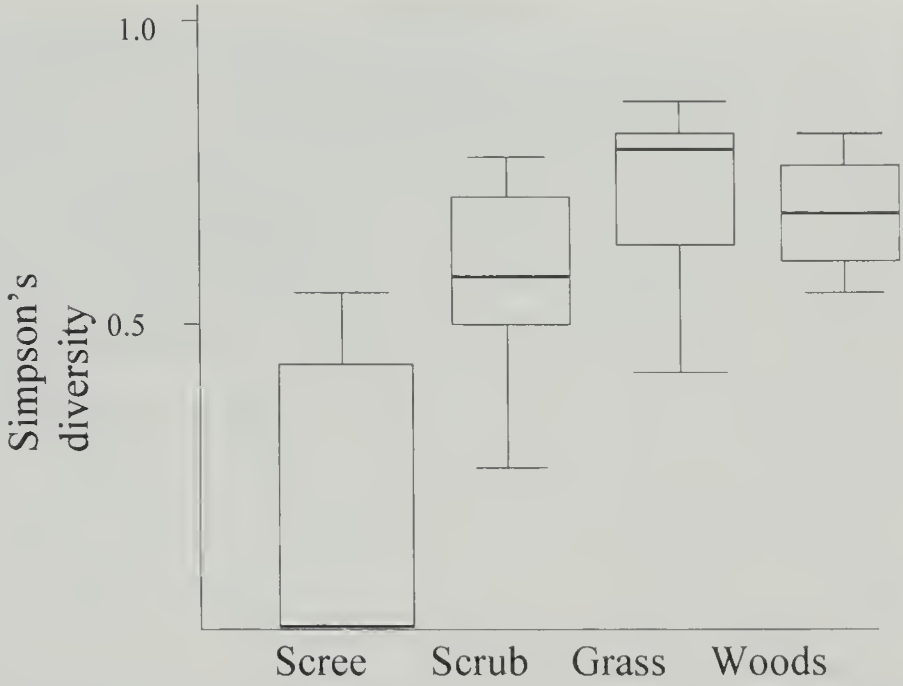

FIGURE 3. Boxplot showing Simpson's diversity of soil cores from each habitat sampled in Brockham Quarry.

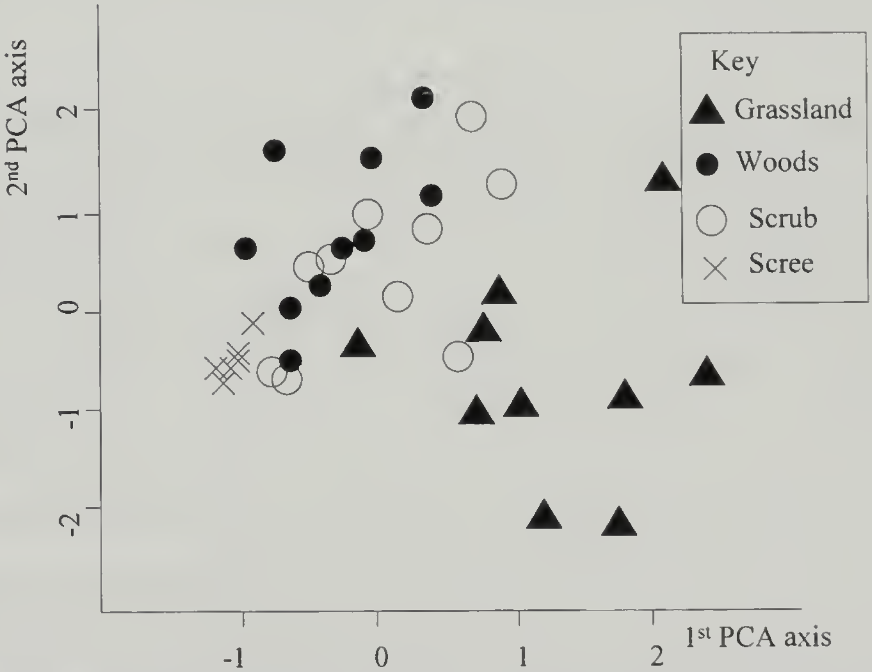

FIGURE 4. Principal Components Analysis of the Collembola in each of forty soil cores collected from Brockham Quarry, showing the habitat from which each core was collected.

Discussion

The Collembola remain an under-studied group despite their ubiquity, so even this small dataset represents a useful contribution to our knowledge of this group. Most of the species recorded here are routinely encountered, but the occurrence of *Folsomides parvulus* is noteworthy for being the third UK record. One of the first two records was in another chalk quarry (Parr 1978). Since this genus is believed to be adapted to dry conditions (Fjellberg 1982) their discovery in chalk quarries is interesting but not surprising. *Cyphoderus albinus* is a myrmecophile, so its relatively frequent occurrence in the grassland areas almost certainly reflects the suitability of this habitat for ants. *Lepidocyrtus curvicollis* and *L. cyaneus* are common surface-dwelling species. *Isotoma notabilis* is common, widely distributed and both probably parthenogenetic (Fjellberg 1982, Hopkin 1997).

The densities of all species were rather low, even given that the means included data from a barren scree slope. This probably reflects the mechanical disruption caused to the soil samples in their removal and transport by hand over a kilometre back to a car, as well as the dry nature of the site.

The most unexpected outcome of the data was that the most suitable habitat for Collembola appeared to be the grassland, not the woodland despite its deeper soil. This could be an artefact, caused by the grassland soil cores remaining more intact after transportation than the leaf litter samples due to a thick mat of roots. Whatever the origin of this anomaly, it explains the lack of correlation between species distribution and soil properties, since the extreme soil values come from woodland while the extreme Collembola densities are from the grassland.

Acknowledgements

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Book review

The NEW reading the landscape. Fieldwork in landscape history. Richard Muir. University of Exeter Press, Exeter. 2000. 256 pp. £18.99 softback, ISBN 0 85989 580 7, £45 hardback, ISBN 0 85989 579 3.

This book is a completely rewritten and more advanced version of *Reading the landscape,* published in 1981, but not having seen the original I cannot compare the two. There are nine chapters ranging from Woodlands, Forests and Parks to Landscapes of Belief.

I did not like the style of the book and the way it was arranged. Richard Muir has an easily readable style but some of the chapters have so many quotations within the text that they appear to be written by different authors at the same time. Another criticism is that most of the maps, figures and tables (although near the relevant text) are not cross-referenced into the text. I personally found some of this heavy going. The book became easier when I began to look at it as two books in one. Most of the text discusses the subject and illustrates the points with maps and photographs — Book one. The tables and maps act as a reference or 'aid to' the subject — Book two.

When using the book as an 'aid to' I particularly liked the map illustrations which sought to show how different features could be recognized. For instance one map of six drawings showed different field shapes and sizes from prehistoric to parliamentary enclosure and simply by letting you compare the differences, gave a fascinating insight into how agricultural use has changed field shapes over the years. The associated caption made the statement that field sizes and shapes provide far better insights into the history of the countryside than the claims associated with hedgerow dating. The text at this point set out some solid reasons why hedgerow dating (age of hedge = number of species per 30 yards × 100) cannot be relied on but there was no cross reference. Another map gave a clear drawing of a church showing some of the diagnostic features which may assist in interpreting the history of a church. Combined with detail in a table this gave a clear and uncluttered view of what to look for.

These examples illustrated for me how much more effective the combination of maps and tables were at drawing your attention to the main points to look for rather than trying to bring together text, maps and tables as you read. Perhaps this is the reason why the author omitted the cross referencing within the text. It might have been better to have the discussion with all its informative detail followed by a reference/aid to section at the end of each chapter.

Having said this I would not wish to dissuade those with an interest in this subject from obtaining the book. It contains a wealth of information with good illustrations to enable you to understand how different aspects have changed from early times onward. There is some fascinating detail here. The photographs (inset as figures) are very good and many of the associated captions also give useful information. The tables are extremely useful ranging from checklists (e.g. checklist for field work in woodland landscapes); how to identify features (e.g. identifying road types) and clues in place names (e.g. place and field names associated with common fields). Each chapter has its own list of references and many of the quotations in the text give actual page numbers for the relevant reference — very useful. The references themselves are of great value to someone who wishes to undertake a wider study of a particular aspect of landscape history.

Despite having some personal criticism of the way this book is arranged it is still to be recommended.

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Spider records for London and Middlesex counties in 2000

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Abstract

New and interesting spider records for the counties of London and Middlesex in 2000 are detailed. There was one new record for London and three new records for Middlesex, but one species should be removed from the Middlesex list.

Introduction

During 2000 collecting by the writer has been somewhat restricted although pitfall trapping at Queen's Wood has continued for the twelfth consecutive year. Two additional lists have been sent to the writer by Peter Harvey, the National Organizer of the Spider Recording Scheme and Recorder for Essex. These were lists from collections made by him at a private site called Haringey Heartlands on derelict railway sidings near Alexandra Park, at a previously uncollected site called Rammey Marsh at Freezywater (Middlesex) near the point where the M25 crosses the River Lea, at Charrington's Wharf on the Isle of Dogs and at some other sites in north and east London.

In 2000 a total of 134 species was recorded in the two counties of London and Middlesex of which one (marked * below) was new to London and three were new to Middlesex (marked ** below).

Nomenclature and the new order in the list of families are according to the recently published checklist (Merrett and Murphy 2000).

ARANEIDAE

Neoscona adianta. This attractively marked orb-web spider has been recorded several times in Middlesex, though not in London, but the discovery of specimens at Rammey Marsh by Peter Harvey in May 2000, adds another point to a most interesting distribution. Something about London, the main conurbation that is, appears to be inimical to this spider — probably some combination of present or past levels and nature of pollution and disturbance. It is known from several points on the edges of London, but not from any similar sites nearer the centre of the conurbation. It is currently recorded from Barking Creek and Thames Wharf on the east side of London, Richmond Park, Hounslow Heath and Feltham railway sidings on the west, and now Rammey Marsh in the north, but from no other sites further in. Members are urged to look out for it, as more records are needed!

LYCOSIDAE

*Pardosa agrestis**. This rare wolf spider is a Nationally Notable B species, which had been recorded from Middlesex by Locket et al. (1974) but without a specified locality. During 2000 Peter Harvey found specimens at both Rammey Marsh and at Charrington's Wharf on the Isle of Dogs (London) in June and August respectively, the latter being a new record for London.

Arctosa perita. This beautifully marked wolf spider commonly found on coastal sand dunes and other dry places has been recorded in Middlesex previously according to Locket et al. (1974) but without a specific locality. Peter Harvey found it in June at Haringey Heartlands on the derelict railway sidings.

AGELENIDAE

*Textrix denticulata***. This small dark spider with annulated legs has not apparently been recorded from Middlesex previously, although it is known from most other counties in England (although not from London). In July 2000 Peter Harvey found specimens at Haringey Heartlands.

HAHNIIDAE

Hahnia helveola. This spider, which appears to be only associated with ancient woodland fragments in the London area, has previously been recorded from both Highgate and Coldfall Woods (Middlesex), and in 2000 it was found in Queen's Wood for the first time. A single male of this winter-active species (Milner 2000*a*: 135) was trapped by the writer, in November.

PHILODROMIDAE

Philodromus albidus. Previously only recorded in Middlesex from Hounslow Heath, in May 2000 Peter Harvey found a specimen at Rammey Marsh.

THOMISIDAE

Ozyptila simplex. Previously only recorded in Middlesex from The Paddock, Tottenham, Peter Harvey found a specimen at Rammey Marsh in May.

SALTICIDAE

*Bianor aurocinctus***. This jumping spider had not previously been recorded for Middlesex although there are a number of records nearby in Essex. Two specimens were taken by Peter Harvey at Rammey Marsh in May although he subsequently informed me that later searches failed to produce any further specimens.

*Talavera (=Euophrys) aequipes***. This tiny speckled jumping spider has been found at a number of sites in London, including two separate areas on Hampstead Heath, but strangely had not previously been recorded from Middlesex. In July 2000 Peter Harvey found specimens at Rammey Marsh and also at the derelict railway sidings near Wood Green called Haringey Heartlands. The dry, gravelly habitat only occurs rarely in London away from railway property. However the Claygate Beds above the London Clay do weather to a gravelly soil such as on the upper slopes above the Vale of Health at Hampstead Heath and *T. aequipes* also occurs there. If more dry sites along the railway lines of London were investigated it is quite likely that this attractive species would be found to be quite widespread.

Re-examination by Peter Merrett of *Euophrys* material from Bounds Green Wilderness, previously reported as being *E. herbigrada* (Milner 2000*a*), has shown that these specimens are in fact *E. frontalis. E. herbigrada* should be removed from the Middlesex species list.

Acknowledgements

I wish to thank Peter Harvey for providing virtually all the interesting spider records for Middlesex and London in 2000 and Peter Merrett from re-examining the *Euophrys* material.

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London butterfly monitoring report for 2000

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Abstract 169
Introduction 169
Methods 169
Results 171
Discussion 179
Acknowledgements 179
References 180

Abstract

Collated indices for butterfly species in London for 2000 are presented, together with some casual records. For the collated indices, data were available from nineteen butterfly transects that were walked in 2000. In addition, three new transects were established in 2000 and could contribute to the calculation of the collated indices from their second year. Thirty-three butterfly species were recorded on transects in London in 2000. It was a migratory year for the clouded yellow *Colias croceus*, and to a lesser extent for other migrants such as red admiral *Vanessa atalanta* and painted lady *Vanessa cardui*. The trend of long-term increases continued for the purple hairstreak *Neozephyrus quercus*, peacock *Inachis io* and gatekeeper *Pyronia tithonus*. Species with declines in 2000 as compared with 1999 included small and Essex skippers *Thymelicus sylvestris* and *Thymelicus lineola*, small copper *Lycaena phlaeas*, and small heath *Coenonympha pamphilus*. The index for small tortoiseshell *Aglais urticae* was the lowest since the collated index commenced, but none of these yet shows a long-term decline. A record of wood white and of wall brown were made at a non-transect site on the same day, but due to the rarity of the two species there is a possibility that they were from released stock.

Introduction

This paper describes changes in the abundance of butterflies in London in 2000 as compared with previous years, primarily using data from sites where butterflies are monitored. London is defined, for the purposes of this paper, as the area encompassed by the London Boroughs. Butterflies are monitored between April and September using a method that is widely adopted throughout the United Kingdom (see below). By repeating the monitoring from year to year, changes and trends can be highlighted. As the same method is used at each site, it is possible to collate the data to produce indices of change for butterfly species across a series of sites or of a geographic area. Indices can also highlight divergent changes in abundance of species at individual sites in comparison with regional trends.

A brief description of the system for monitoring butterflies in London and the calculation of collated indices was provided by Williams (2000). Data were available from nineteen of the transects walked in 2000. In addition, three new transects were established that could contribute to the index from their second year. Casual records by London Natural History Society observers throughout London are mentioned where they provide additional information to that available from the transects. In that respect, the policy adopted by Plant (1999) is continued, in that the London Natural History Society works with the county branches of Butterfly Conservation in and around London for the effective use of butterfly records and transect data. Casual records are passed to Butterfly Conservation where information can be used in distribution and mapping schemes.

Methods

Monitoring was undertaken by the transect walk method, a standard adopted at several hundred sites in the United Kingdom. Full details of the method have not been repeated here as they are described elsewhere (see Williams 2000 and the references cited there). At each site a walk was undertaken along the same route, each week, between April and September inclusive, within a standard range of weather conditions conducive to butterfly flight. Counts were made of the number of adult butterflies observed to provide a total for each species for the year at each transect. Totals used for this paper include estimates for weeks missed due to poor weather or the unavailability of the recorders, calculated from the averages of the two weeks on either side. Collation of the data from the transects in London was undertaken as described by Williams (2000), but see also Crawford (1991) for an introduction to the use of collated indices in wildlife monitoring, and Pollard and Yates (1993) on the use of collated indices in butterfly monitoring. Note that collated indices are not absolute counts of the population (nor are the original site counts), but indices of abundance. The indices are relative from year to year, not from species to species.

At the time of the preparation of this paper, data were available from nineteen of the transects walked in London during 2000, out of the twenty transects in the index for which there is data from two or more years. Three transects were first walked in 2000 and, while their records have been included in the species accounts, two years of data will be required before they contribute to the calculation of the indices. Each transect is briefly described below. Transect and casual recorders are listed in the Acknowledgements. The years listed refer to the years for which there are usable data.

Hampstead Heath: 1978–2000. Located in the London Borough of Camden, the site is managed by the Corporation of London. The transect is largely through scrub with rough grassland.

Fryent Country Park: 1986–2000. The transect is in the London Borough of Brent. Habitats include hay meadows, hedgerows, woodland and scrub.

Beane Hill: 1988–2000. Located in the south-east of Fryent Country Park, in the London Borough of Brent. The transect is largely through young woodland that was planted in the mid to late 1980s.

Gutteridge Wood: 1990–2000. The site is in the London Borough of Hillingdon. The mature oak woodland has a hazel understorey. Other habitats include grassland with scrub, boundary ditches and the Yeading Brook.

Coulsdon Common: 1990–2000. Managed and owned by the Corporation of London and situated in the London Borough of Croydon. The site includes grassland and woodland with mown rides.

Farthing Downs and Happy Valley NW: 1990–2000. Managed and owned by the Corporation of London and situated in the London Borough of Croydon. Chalk grassland with woodland.

Kenley Common: 1990–2000. Managed and owned by the Corporation of London and situated in the London Borough of Croydon. Habitats include grassland with some oak woodland.

Riddlesdown: 1990–2000. Managed and owned by the Corporation of London and situated in the London Borough of Croydon. Habitats include chalk grassland, scrub and woodland.

Clifford Road Allotments: 1994–1995, 1997–2000. Allotments site in the London Borough of Barnet.

Mitcham 'route A': 1995, 1996, 1998–2000. Situated in the London Borough of Merton and managed by the Mitcham Common Conservators. The habitats include ruderal vegetation, acidic grassland, scrub and secondary woodland.

Mitcham 'route B': 1995–2000. London Borough of Merton. Managed by the Mitcham Common Conservators. The main habitat is neutral grassland with some secondary woodland and acidic grassland.

Forty Hill: 1996–2000. A private garden of a family home, situated in the London Borough of Enfield.

Wandsworth Common Woodland: 1997–1999. London Borough of Wandsworth. Habitats include oak scrub that has grown during recent decades, grass clearings and one area of meadow with scrub.

Railway Fields: 1997–2000. London Borough of Haringey. The main habitats are grassland, scrub and woodland.

Cranford Park: 1997–2000. Located between the M4 motorway and Heathrow Airport in the London Borough of Hounslow. Habitats include woodland, grassland and wetland.

Hutchinson's Bank Nature Reserve: 1998–2000. Located in the London Borough of Croydon and managed by London Wildlife Trust. Chalk grassland with woodland.

South Norwood Country Park: 1998–2000. Located on the boundaries of the London Boroughs of Croydon and Bromley, but owned and managed by the London Borough of Croydon. Former sewage works.

Trent Country Park: 1998–2000. London Borough of Enfield. Woodland and grassland.

Tower Hamlets Cemetery Park: 1999–2000. The cemetery is in the London Borough of Tower Hamlets. Habitats include grassland, and woodland with rides.

Abney Park Cemetery: 1999–2000. Located in the London Borough of Hackney. Woodland.

Brent Reservoir: 2000. Located in the London Boroughs of Barnet and Brent. Habitats include rough grassland, disused allotments, low scrub, mown grasslands, oak woodland and elm woodland.

Elthorne Rough: 2000. London Borough of Ealing. Grassland.

The Gallops (Featherbed Lane roadside verge): 2000. Located in the London Borough of Croydon. Chalk grassland and scrub.

Results

Collated indices for each species were calculated and for the years 1990 to 2000 are presented in Table 1. The order and nomenclature follow Asher et al. (2001). The index is based on nineteen transects for which data are available for 2000. Estimates of the relative changes in the numbers counted for each species from year to year are given by the difference in the numerical figures. For example, a butterfly with an index of 50 in one year and 25 the following year would have been seen in half the numbers in the second year as compared with the first year. Indices have been rounded to the nearest whole number and have usually been set at 100 in 1990 or the first year of record: for a technical discussion see Crawford (1991). In Table 1 a zero implies that a species was not observed on transects in that year, whereas a blank entry indicates that no transects were walked within the expected London range of that species. A question mark indicates that a species was present in that year, but that data for subsequent years or for more transect sites are required before the calculations can be completed. Reliability of the indices increases with the number of transects: one transect was walked in 1978, rising to two in 1986, three in 1988, eight in 1990, and to nineteen in 2000. Reliability of the indices may be lower for species with low counts.

TABLE 1. Collated indices for butterfly species in London, 1990–2000. Indices have been rounded to the nearest whole number and have usually been set at 100 in 1990 or the first year of record, though indices may be set at 100 in other years where this aids interpretation. A blank indicates no transect records for that species in that year. A zero implies that that species was not observed on transects in that year. A question mark indicates that a species was present in that year, but that data for subsequent years and/or for more transect sites are required before the calculations can be completed. See the text for further information.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Small and Essex skipper	100	254	282	78	249	118	175	175	94	106	82
Large skipper	100	62	235	217	227	134	64	81	47	51	35
Dingy skipper	100	300	125	300	0	0	0	25	80	70	85
Grizzled skipper	0	0	0	?	?	0	0	?	100	217	83
Clouded yellow	0	0	0	0	0	0	100	0	0	0	883
Brimstone	100	129	169	119	68	129	116	86	80	78	123
Large white	100	89	567	82	118	136	34	123	248	97	107
Small white	100	165	267	72	105	222	101	294	148	91	137
Green-veined white	100	52	242	88	70	151	71	182	224	105	112
Orange-tip	100	155	118	88	33	71	43	83	64	51	73
Green hairstreak	0	0	100	250	0	150	50	150	?	?	?
Purple hairstreak	0	0	100	200	200	156	156	437	612	789	910
White-letter hairstreak	0	0	100	50	0	50	150	90	40	20	30
Small copper	100	38	19	13	32	61	59	58	56	17	9
Small blue	0	0	0	0	?	0	0	?	100	54	58
Brown argus	100	132	74	21	53	95	83	100	11	14	22
Common blue	100	98	46	24	90	137	67	80	36	51	42
Chalkhill blue	100	117	54	13	93	109	109	304	75	180	90
Holly blue	300	30	7	4	1	83	132	26	75	59	70
White admiral									100	0	0
Red admiral	100	57	279	100	131	302	231	114	174	138	288
Painted lady	100	15	69	0	20	19	1,597	17	?	?	?
Small tortoiseshell	100	145	1,023	447	172	270	118	278	178	138	68
Peacock	100	250	963	1,113	446	577	790	828	1,121	1,203	1,494
Comma	100	82	367	109	106	155	115	157	143	138	239
Dark green fritillary								?	100	123	43
Silver-washed fritillary										100	300
Speckled wood	100	101	157	169	214	151	73	127	151	165	182
Wall brown	100	13	3	3	2	1	0	0	0	0	0
Marbled white							?	?	100	88	77
Gatekeeper	100	97	133	80	91	138	166	158	140	197	234
Meadow brown	100	197	126	54	82	108	141	123	173	154	150
Ringlet	100	224	299	181	311	194	65	143	239	301	411
Small heath	100	94	42	11	4	6	23	30	23	9	5

Species accounts are presented below. For the index transects, a long-term trend in numbers for each species was tested with a correlation between the logarithm of the imputed total count and the year of the count. Few of the species yet show a statistically significant trend over the years since 1990. This is because of the large fluctuations in the numbers from year to year as yet obscuring long-term trends. Results from the next few years should establish some further significant trends. The 'Total count' for a species gives an indication of the size of the count including estimated counts for missing weeks, from the nineteen transects from which the indices were calculated. Where the number of transects on which a species was recorded is given, the number is out of the twenty-two transects walked in 2000 (i.e. the nineteen index transects and the three new transects at the Brent Reservoir, Elthorne Rough and The Gallops). The narrative may also include comment from a further three transects (Bedfont Lakes, Hounslow Heath and Cranebank) that were only partially walked during 2000 and from casual records.

SMALL SKIPPER *Thymelicus sylvestris* and ESSEX SKIPPER *Thymelicus lineola*
The small and the Essex skippers are generally counted together by the transect walkers, due to the difficulty of separating these species in flight. At least one of these two species was recorded on each transect except Elthorne Rough in 2000. The index was lower than in 1999 and the second lowest since the index commenced in 1986. There was however an increase at some transects, including Mitcham Common (route B) transect. That transect had the highest count. At seven out of the twenty-two transects, attempts were made to identify at least a sample of the two species separately. Of a combined sample of 296 individuals, 67 per cent were small skippers and 33 per cent were Essex skippers, a similar ratio to that in 1999. Nationally, the ranges of both species have increased since 1970–82 (Asher et al. 2001). Total count: 1,512.

LARGE SKIPPER *Ochlodes venata*
The index for the large skipper declined to the lowest since the index commenced in 1986. At some transects, however, there were increased numbers as compared with 1999. Large skippers were recorded on most transects. The highest counts were at Tower Hamlets Cemetery Park, The Gallops and Hutchinson's Bank Nature Reserve. Total count: 224.

DINGY SKIPPER *Erynnis tages*
The dingy skipper was recorded on three of the 'North Downs' transect sites in south London. Total count: 49.

GRIZZLED SKIPPER *Pyrgus malvae*
The grizzled skipper has a distribution in London restricted to downland sites on the southern edge of the area. Recorded only at Hutchinson's Bank Nature Reserve and The Gallops in 2000. The data are too few for a reliable index. Total count: 5.

WOOD WHITE *Leptidea sinapis*
Whilst there have been no transect records for this species, a single wood white was reported by Robert Callf and Robin J. White at a site in Enfield on 22 May 2000. Barry Weston and Andrew Middleton visited the site to verify the identification; and photographs were taken by Andrew Middleton. At the same site, and about 130 metres away, a wall brown was observed about fifteen minutes before the wood white (see below). There have been no recent records of the wood white in London (Plant 1987) and few from Hertfordshire (Sawford 1987). In view of the rarity of these two species in London, the records should be treated as possible releases. Total count on transects: 0.

CLOUDED YELLOW *Colias croceus*
A notable migration of the clouded yellow occurred during 2000. The clouded yellow was recorded on nine of the transects in the index. Eleven were counted at Mitcham Common (route B), eleven at Trent Country Park, nine at Tower Hamlets Cemetery Park, eight at Farthing Downs and Happy Valley, seven at Hutchinson's Bank Nature Reserve, four at Riddlesdown, four at South Norwood Country Park, three at Kenley Common and two at Clifford Road Allotments. The clouded yellow was also noted on the three new transects at the Brent Reservoir (four), Elthorne Rough (two) and The Gallops (one). At a further three sites, where transects were walked in some weeks, clouded yellow numbers were: Bedfont Lakes (eighteen), Hounslow Heath (five) and Cranebank (one). Casual records from the London Natural History Society recording area were also received and approximately 175 of these were from within the London (Boroughs) area used for this paper. Attention is drawn to the comments in the Discussion, where the clouded yellow illustrates some of the differences between transect and casual methods of recording butterflies. Three of the casual records were of the pale form of the female, called *helice*. Using both the transect and the 175 casual records, the migration was first noted on 10 June and the last record was on 4 October. An early summer migration peaked in late June. Larger numbers were recorded for the late summer generation that peaked in late August with relatively high counts continuing into the second week of September. Due to the absence (zero counts) of this species in London in some years, it has proved difficult to calculate reliable index values. The index values given in Table 1 are estimates based on eleven transects walked in both 1996 and 2000. In London the nearest comparison with 2000 appeared to be the migration of 1983, which pre-dated the formation of a transect network so a direct comparison is difficult. Plant (1984) provided an account of that migration using records from casual observations. Both migrations followed a similar pattern, though in 2000 clouded yellows were observed continuously throughout the summer, and there was less of a difference in proportion between the early summer migration and the late summer generation. Plant (1984) commented upon an apparent relationship between river valleys and sightings. Although a similar analysis has not been attempted for the year 2000, a majority of all the records appear to be in the vicinity of water: the Thames, other rivers, lakes and reservoirs. Total count: 59.

BRIMSTONE *Gonepteryx rhamni*
There is no evidence of a trend in recent years. Recorded on all but two transects in 2000, the brimstone may be increasing at some urban sites. Almost a third of the total was from Hutchinson's Bank Nature Reserve, with high numbers from other chalk sites in south London including Farthing Downs and Riddlesdown. Total count: 547.

LARGE WHITE *Pieris brassicae*
There was considerable variation in trends from site to site and the index shows no trend over the last ten years. The large white was recorded at each transect site in 2000, with the highest count at Tower Hamlets Cemetery Park. Total count: 730.

SMALL WHITE *Pieris rapae*
Despite wide fluctuations, there is no evidence of a consistent trend in recent years. Recorded on all transects, with the highest counts at Mitcham Common (route B), Tower Hamlets Cemetery Park and South Norwood Country Park. Total count: 1,225.

GREEN-VEINED WHITE *Pieris napi*

Green-veined whites were recorded on each transect in 2000. The highest count was at Tower Hamlets Cemetery Park. Total count: 1,412.

ORANGE-TIP *Anthocharis cardamines*

The orange-tip was recorded on all but two transects in 2000 with the highest counts at Tower Hamlets Cemetery Park and South Norwood Country Park. There was also a high count at the Brent Reservoir transect. The rise in the index in 2000 was within the range of recent years. Total count: 255.

GREEN HAIRSTREAK *Callophrys rubi*

The green hairstreak has a restricted distribution in London. Only one individual was recorded on the index transects in 2000, though two were recorded at The Gallops. The numbers have been too small to calculate a reliable index. Total count: 1.

PURPLE HAIRSTREAK *Neozephyrus quercus*

The index for the purple hairstreak was higher than in 1999 and has shown a statistically significant increase since 1992, the first year for which this species was recorded on a transect in London. The purple hairstreak was recorded on five of the nineteen index transects. The highest count was, however, on the new transect at the Brent Reservoir. Purple hairstreaks are generally on the wing in the evening and early daylight hours only and therefore it is one of the few butterfly species for which transect recording is inefficient. Total count: 21.

WHITE-LETTER HAIRSTREAK *Satyrium w-album*

White-letter hairstreaks were recorded from two transects in 2000, Trent Country Park and Coulsdon Common. Total count: 3.

SMALL COPPER *Lycaena phlaeas*

The index fell to approximately half that of 1999. This is approximately a tenth of the index of 1990. Nationally, the abundance of the small copper fluctuates widely and is affected by the weather (Asher et al. 2001). Small coppers were recorded on two-thirds of the London transects in 2000. The highest count was at Trent Country Park. Total count: 142.

SMALL BLUE *Cupido minimus*

The small blue is restricted to downland in London and was recorded on one transect in 2000. There is currently insufficient data to calculate a reliable index for all years. Total count: 15.

BROWN ARGUS *Aricia agestis*

The index for 2000 increased as compared with 1999, but numbers remain low following a decline in the late 1990s. The brown argus was recorded from seven transects, with the highest counts at Hutchinson's Bank Nature Reserve and Farthing Downs. Though a species of calcareous grassland, one was recorded at Tower Hamlets Cemetery Park. Total count: 16.

COMMON BLUE *Polyommatus icarus*

The decline from 1999 to 2000 was within the range of fluctuations in previous years. The highest counts were at Hutchinson's Bank Nature Reserve, Tower Hamlets Cemetery Park and Kenley Common. Total count: 576.

CHALKHILL BLUE *Polyommatus coridon*
The chalkhill blue was recorded on one transect on the southern edge of London where the count was half that of 1999, but similar to 1998 (Figure 1). Total count: 62.

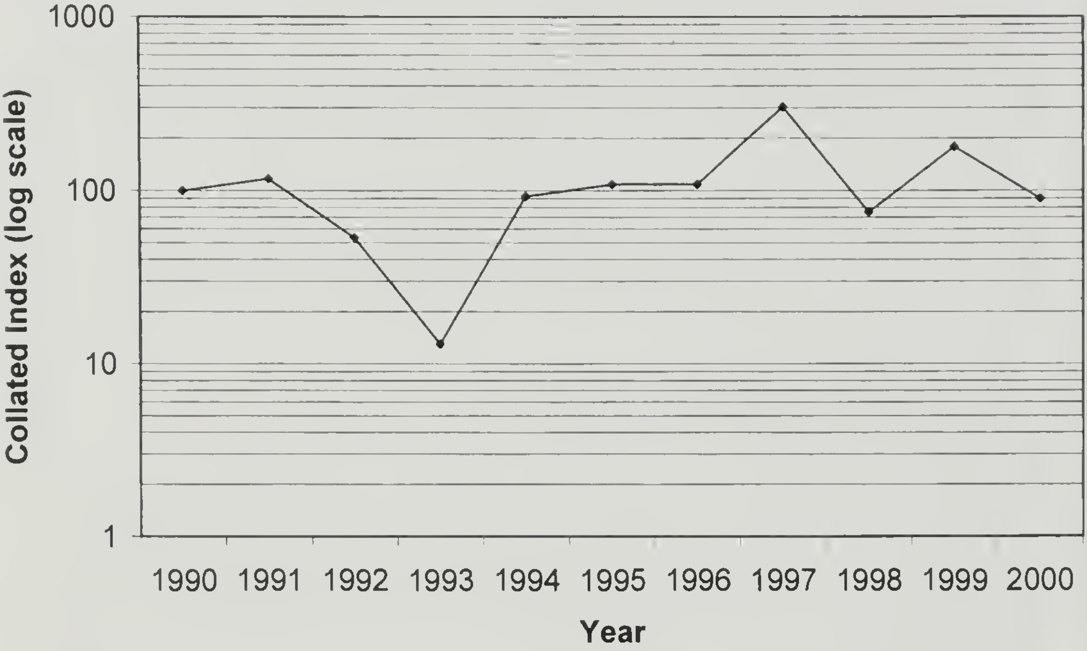

FIGURE 1. **Chalkhill blue**: collated indices for London for the years 1990–2000.

HOLLY BLUE *Celastrina argiolus*
The 2000 index value increased but was within the range of recent fluctuations. Recorded from all but four of the transects, the highest counts were at urban sites, particularly the two cemetery sites of Tower Hamlets Cemetery Park and Abney Park Cemetery. Total count: 313.

RED ADMIRAL *Vanessa atalanta*
Although the index in 2000 was twice that of 1999 and one of the highest since the index commenced, the trend is not statistically significant as there was so much annual variation. Recorded on all transects. The highest counts were at Cranford Park, and then at Abney Park Cemetery and Tower Hamlets Cemetery Park. Total count: 222.

PAINTED LADY *Vanessa cardui*
The migration of 2000 was the best since 1996. It has proved difficult to calculate an index for all years, but for eleven transects walked in both 1996 and 2000, the index in 2000 would have been approximately 7 per cent of that of 1996. The painted lady was recorded on fourteen transects. Total count: 39.

SMALL TORTOISESHELL *Aglais urticae*
Small tortoiseshell numbers were the lowest since the index commenced in 1986 and less than 10 per cent of that of 1992. However, the index has varied so much over the years that the trend is not statistically significant. Asher et al. (2001) have noted large annual fluctuations in the national abundance of the small tortoiseshell. The index was less than half that of 1999, itself a relatively poor year for this species. The autumn 1999 generation was low and after a poor spring flight in 2000, few small tortoiseshells were seen of the summer and autumn flight generations. Total count: 205.

PEACOCK *Inachis io*

The peacock continued to increase in London and was recorded on all transects. Its increase since 1990 approaches statistical significance. The highest count was at Cranford Park. Total count: 1,434.

COMMA *Polygonia c-album*

The year 2000 was good for the comma, with the highest index value since 1992. It was recorded on all but one transect, with the highest counts at Tower Hamlets Cemetery Park and Cranford Park. Total count: 577.

DARK GREEN FRITILLARY *Argynnis aglaja*

Seen at Hutchinson's Bank Nature Reserve, 2000 was not a good year for the species there but too few years have been counted to establish a trend. Total count: 17.

SILVER-WASHED FRITILLARY *Argynnis paphia*

Three sightings were made of the silver-washed fritillary from only the second transect on which this species has been recorded in London. Total count: 3.

SPECKLED WOOD *Pararge aegeria*

The speckled wood has increased to become the second-most common butterfly on the transects. Recorded on all transects, with the highest counts at Tower Hamlets Cemetery Park and Beane Hill. The index has increased from zero in 1986: to give some examples, numbers recorded in 2000 were 90 on the Hampstead Heath transect and 129 at Fryent Country Park. At Beane Hill, 24 speckled woods were recorded in 1988, the first year for that transect, and increased to 272 in 2000. Changes in the index since 1990 for London as a whole, however, have not been statistically significant. Total count: 2,391.

WALL BROWN *Lasiommata megera*

Whilst there have been no records of the wall brown on transects in London since 1995, a singleton was reported by Robert Callf and Robin J. White at a site in Enfield on 22 May 2000. The same individual was reported again on 24 May and 2 June. In view of the rarity of this species in London (and see also the account for the wood white), the record should be treated as a possible release, though any evidence that populations are established will be included in a future report. The inclusion in the collated index of the Clifford Road allotments transect brings to light a 1995 record for the wall brown, one year later than the previously known last record in 1994. Numbers on the eight transects walked in both 1990 and 1995 declined from a total of 40 to zero by 1994, a statistically significant decline. Total count on transects: 0.

MARBLED WHITE *Melanargia galathea*

The marbled white is localized to tall unimproved grassland, particularly but not only on downland. Of the London transect sites, there is a colony at one transect where counts were slightly lower as compared with 1999. Occasionally stray individuals are recorded on other transects and elsewhere in London. Total count: 302.

GATEKEEPER *Pyronia tithonus*

The gatekeeper continues to increase in London. The index in 2000 was the highest and over twice as high as in 1990, a statistically significant increase. There was further evidence of the recolonization and then establishment at sites in London, particularly in the built-up areas. The increase in the index would have been more pronounced if it were not for the anomaly of Gutteridge Wood, where a colony that was established there in 1990, has declined by about 80 per cent during the past decade. A possible explanation could include the shading over of some of the woodland paths and rides. Gatekeepers were recorded on all transects in 2000 with the highest counts at Hutchinson's Bank Nature Reserve and Farthing Downs. Total count: 2,026.

MEADOW BROWN *Maniola jurtina*
The index was slightly lower than in 1999. However, there was no consistent trend across transect sites. The highest count was at Fryent Country Park, where a recovery followed the reduction due to the early hay harvest in 1999 (Williams 1999). The meadow brown is the most common species on the transects and was recorded on all transects. Total count: 10,028.

RINGLET *Aphantopus hyperantus*
Although the ringlet has increased since a low point in 1996, to reach the highest since the index commenced in 1990 (Figure 2), this was the first year to top the values reached in 1994. More years are needed to establish any long-term trend. Recorded on seven transects with the highest count at Hutchinson's Bank Nature Reserve and then at The Gallops. Of the transects, the ringlet is virtually confined to transects on the edge of south London, though one ringlet was recorded at Tower Hamlets Cemetery Park. Total count: 1,440.

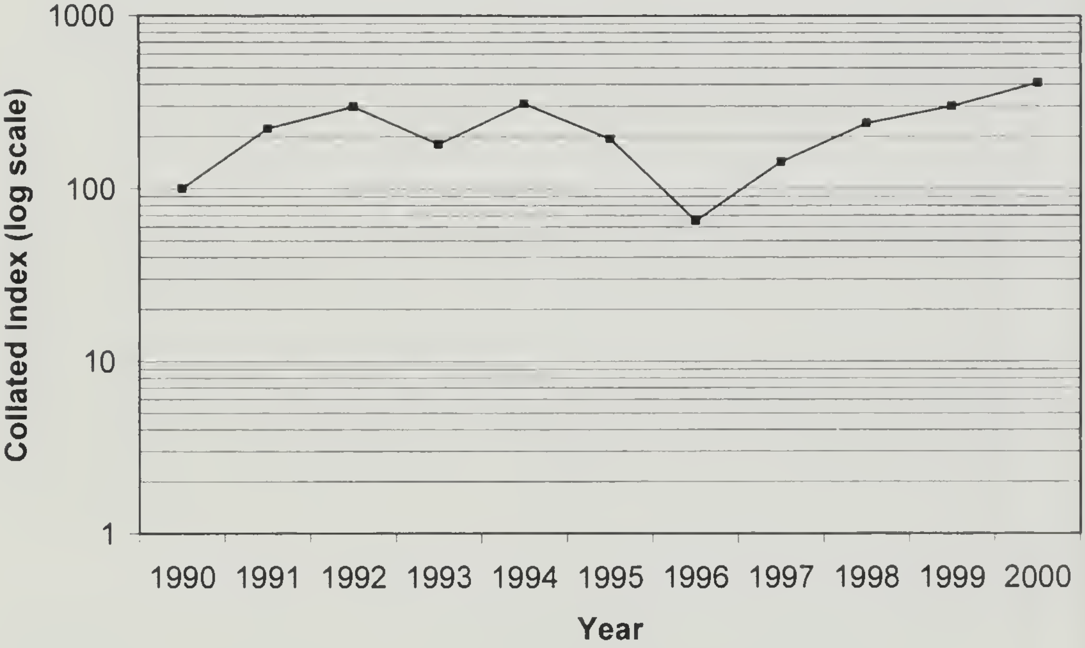

FIGURE 2. **Ringlet**: collated indices for London for the years 1990–2000.

SMALL HEATH *Coenonympha pamphilus*
The small heath index peaked in 1990 and again at a lower level in 1997, with a low point in 1994 and almost as low in 2000. The small heath was present on seven of the eight transects walked in 1990, but on only two of those in 2000. While this could represent a cycle, a similar decline in abundance and the loss of colonies has been noted in Hertfordshire (Murray and Wood 2001) and nationally (Asher et al. 2001). The species was recorded on seven transects, with the highest count at Trent Country Park. Total count: 225.

Discussion

Coverage increased during the year with data available from nineteen transects walked in 2000, while an additional three transects were walked for the first time but not included in the index. More transects are encouraged to join the index, though the quality of data is more important than quantity; and continuity of the existing transects is a higher priorty than the establishment of new transects.

As indicated in the Methods, casual records received for both London and within the wider London Natural History Society recording area are routinely passed to the respective county branches of Butterfly Conservation, with whom there is also co-operation for the effective use of transect data. Casual records of interest have however been noted in the text. It is instructive to compare the data received from transects and from casual records for the clouded yellow. Clouded yellows accounted for approximately 0.3 per cent of all butterflies recorded on transects in 2000, but approximately 12 per cent of all casual records received from observers. This highlights one of the differences between these two surveying techniques, with transect recording being systematic at a number of sites and casual recording relying on observers who may be anywhere in London and who may not note the more commonplace species. It was also apparent that the peak weeks noted by casual recorders for the summer generation were in the week beginning 12 August through to the week ending 1 September. On transects the peak weeks commenced on 19 August and continued until 15 September. However, transect recording usually finishes by 29 September, whereas casual records of clouded yellow continued to be made into early October.

Thirty-three butterfly species were recorded on transects in London in 2000. Two further species were recorded elsewhere in London, though the circumstances suggest that those could possibly be from released stock. Of the species on transects, 2000 was a migratory year for the clouded yellow, with numbers possibly of an order similar to that of the migration in 1983. To a lesser extent, other migrants such as red admiral and painted lady had a good year. The trend of long-term increases continued for the purple hairstreak and peacock. The gatekeeper continued to increase throughout London, though there was further evidence of a contrary long-term decline at Gutteridge Wood. Species with notable declines in 2000 as compared with 1999 included the small and Essex skippers, small copper, and small heath. The small tortoiseshell declined to the lowest index since the collated index commenced.

The millennium atlas of butterflies in Britain and Ireland (Asher et al. 2001) was published in early 2001 and summarizes information on national changes in butterfly distribution and abundance during recent decades. The *Atlas* was based on both distribution mapping and transect data. Survey results revealed that the past thirty years have been a period of great change for butterflies nationally and in London. The gatekeeper and the speckled wood have moved from the fringes to colonize much of London including the central London parks, while the brown argus is spreading into the south of the capital. The conurbation supports populations of many of the 'wider countryside species' and this is considered to be due, at least in part, to improved environmental management of parks, gardens and other open spaces.

Acknowledgements

The London Butterfly Index is a team effort. In 2000 the transect walkers were Ian Greenwood with assistance from Aaron Beat and Bob Gillam at Hampstead Heath, Mary Taylor, Brenda Hatcher, Kathy Northcroft, Michael Berthoud and Simon Mercer at the Fryent Country Park and Beane Hill transects, Ann Rix at Gutteridge Wood, M.A. Enfield at Coulsdon Common, Gary Aldridge and Louise Niekirk at Farthing Downs and Happy Valley NW, Jo Osmond and Simon Meek at Kenley Common, P. Strugnell and B. Gutteridge at Riddlesdown, Diane Furley and Lorna Arnold at Clifford Road Allotments, Martin Boyle at Mitcham Common, Valerie Carter at Forty Hill, David Bevan at Railway

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Survey of Bookham Common

FIFTY-NINTH YEAR

Progress Report for 2000

General 181
Management tasks on the Bookham Commons 181
Vegetation — an increase in wood violets 182
Birds 183
Butterflies and moths 187
Beetles 189
Bush-crickets and grasshoppers Field Day, 12 August 2000 192
Contributors' addresses 192

General (Ian Menzies, Chairman, Bookham Common Survey)

Our hopes of a fine summer for the millennial year were disappointed by persistent heavy rainfall which raised the Bookham Common water table to ground level and even beyond (see introduction to bird report by Alan Prowse for rainfall details). Although the Common is traditionally a rather marshy place, more small ponds and streams appeared than any of us can remember. Naturally this interfered with some of our projects, but not as much as might be expected.

The ornithologists, led 'from the front' by Dr Alan Prowse, report that the herons managed to raise the number of nests to a record of twenty-two this year, and new species recorded on the Common included the firecrest and common buzzard. Preference shown for blackthorn scrub by nightingales in recent years emphasizes a need to replace the concept of 'scrub clearance' with that of 'scrub management', in recognition of the importance of this type of environment in its own right. Recent scrub management undertaken by The National Trust Warden, Ian Swinney, especially on Bayfield, Isle of Wight and Western Plains, has certainly earned the approval of the ornithologists.

The recently initiated botanical review has continued throughout the year, and some recent findings are now mentioned by Ken Page in his report. There has also been considerable activity by the entomologists. The efforts of Maxwell Barclay, Roger Booth and other coleopterists from The Natural History Museum, South Kensington, have increased the number of recorded beetle species by forty-four bringing the total for Bookham Common above 1,300. Sightings of the purple emperor and silver-washed fritillary butterflies reported by Ken Willmott were surprisingly high considering the poor weather.

Management tasks on the Bookham Commons

(Ian Swinney, Warden, The National Trust)

The year 2000 has seen a continuation of The National Trust's programme for the management of wetlands, woodland, scrub and grassland areas on the Common.

Wetland areas. Heavy rainfall during the year has considerably raised pond levels. This, combined with encroachment of trees that shade pond margins has been accompanied by deterioration in aquatic vegetation which has particularly affected the Isle of Wight Pond. Coppicing of sallow carr on the island and reduction in the water level have been undertaken in the hope of encouraging growth at the lake margin. Thinning has also been undertaken around Bayfield Pond and along the very overgrown margin of Central Ditch.

Scrub management and tree thinning on the plains. Judicious removal of thorny scrub and sapling trees, especially birch and oak, from Bayfield, IoW and Western Plains has been continued, together with grazing, to prevent further loss of grassland areas. In recognition of the importance of scrub with respect to wildlife the policy has come to focus on 'scrub management' rather than merely upon 'scrub clearance'. The success of the nightingale on the Common during recent years is a good example of the importance of this policy, a subject that Dr Alan Prowse has studied in detail and mentions in the present bird report.

Woodland areas. Encroachment on the few remaining open spaces within the woodland, especially by species such as sycamore and Turkey oak which combine vigorous growth with a low 'ecological score' in the UK, has been countered in sites such as Woodland Glade near the junction of Woodland and Tunnel Paths and along the margin of Hollow Path by the ponds. Re-establishment of 'wood pasture' in some of the recently overgrown woodland areas has now become a long-term aim. Thinning of excess saplings which reduces the intensity of competition is a policy that encourages ecological diversity and, by allowing the remaining trees to realize their full potential, improves both their quality and visibility. Widespread failure to control woodland undergrowth during the last half century could be said to have produced a situation where, to turn a phrase around, the 'trees cannot be seen for the wood'! A large part of Hill House Wood has now been thinned.

Clearance of storm damage and bracken pulling. Stacking of fallen trees resulting from damage by gales during 1987 and 1990 in the Mark Oak area has been necessary to allow access for machinery and personnel for purposes of management. During 2000 further pulling of Himalayan balsam has been undertaken by volunteers in this area. Mechanical control of bracken has been undertaken on Eastern, Bayfield and IoW Plains, and it is hoped that it will be possible to continue this in future years.

The National Trust wishes to acknowledge the value of the continued dialogue with the London Natural History Society Survey team on the state of wildlife: this is important for both nature conservation and maintenance of public interest in the Bookham Commons area.

Vegetation — an increase in wood violets (Ken Page)

Viola reichenbachiana pale wood violet has had a restricted distribution on the Common, being found only in Divisions A and B during the previous two surveys. In the present survey we have recorded it additionally in Divisions D, G, R and S, though in limited numbers. We are not certain if these new sightings have been missed in the past or represent a recent spread.

Pale wood violet is a small plant with rather dingy pale mauve flowers with narrow separated petals and is the first of the true wood violets to flower, usually at the end of March. Perhaps its modest appearance could be a reason for it being overlooked.

Viola riviniana common dog violet follows some weeks later and is at its best in early May. It is more conspicuous than the previous species, with larger violet-blue flowers and overlapping petals. It is now recorded abundantly in every Division, despite apparently being absent from C, N, O and R in the 1953 survey.

Apart from the colour and size of flowers and flowering time, the spurs of the species provide the most useful characters for identification. In *V. reichenbachiana* the spur is noticeably darker than the petals and ungrooved. In *V. riviniana* it is paler than the petals and distinctly grooved. The difference in length of sepal appendages is another character used to distinguish the two species but their small size makes them barely discernible. Our research indicates that this difference is rarely considered by the amateur botanist. The other characters appear to be sufficient for determination.

Ian Swinney, The National Trust Warden, recently cleared some of the scrub that bordered the series of ponds in Division N. This has resulted in the appearance of the hybrid between primrose and cowslip, *Primula × polyantha*, which is a first record for the Common. The plant has the large flower size of the primrose, somewhat reminiscent of the garden polyanthus, not intermediate between parents as is usual with this cross.

Finding a plant of *Virburnum lantana* wayfaring tree was unexpected, because this is usually an inhabitant of chalk downland. Growing at the edge of a track made up with hardcore (possibly with some calcareous material) could explain its origin. Alternatively, it could be bird-sown from the fruit in a nearby garden.

Brought in also with the hardcore were a number of garden plants: *Sedum album, S. spurium, Lobelia erinus, Papaver somniferum, Melissa officinalis, Viola × wittrockiana* together with the now rare cornfield weed, *Chrysanthemum segetum.*

In Division M, *Forsythia suspensa* is becoming established. The species has long slender stems that, unsupported, droop to the ground where they readily root. It is probably discarded from a nearby garden.

Birds (Alan D. Prowse)

Introduction. An extremely wet year made things difficult for the birds, and for recording. It was the wettest April and the wettest autumn on record, and the total rainfall from April 2000 to March 2001 was greater than any year since records began in the eighteenth century. Much of the wooded area was impassable at times. Western Plain was flooded when the first nightingales returned, but some were able to take up territory as the water level subsided.

Highlights of the year. There were two new species for the Common during the year. On 23 April Pat and Gwilym Evans had just finished watching a pair of hawfinches feeding on Central Plain when a firecrest appeared in a nearby bush. The record has been submitted to Surrey Bird Club recorders. On 18 May the author saw a common buzzard mobbed by jackdaws over Isle of Wight Plain at short range, then watched the same bird later as it soared over Hill House Wood. The species is now re-established as a breeding bird in Surrey. A male whinchat on 29 April (CP) and a skylark on 23 April were unusual visitors.

Breeding season. The ponds were again disappointing. A radical clearance of the Isle of Wight Pond at the end of the year may improve the situation. A little grebe was rippling in on 7 April, but did not breed this year. A few pairs of coots nested. With the extremely wet conditions, moorhens were widely distributed along the streams as well as on the various ponds. A pair of Canada geese nested but the success is unknown.

On 7 April ADP watched a pair of mandarin ducks land in one of the postmature oaks by the ponds. The female landed on top of the trunk and ran up and down the main branches for several minutes looking for a possible nesting hole. She then flew to the next tree and repeated the process, until disturbed by a horse rider. No record of this behaviour has been found in the literature consulted. At least two pairs of mandarins were known in that area.

Heronry. The heronry has become more diffuse, and nests are now in five groups. There were twenty-two successful nests (RS). This colony started in 1988, and records since inception are as follows:

1988	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
1	4	6	8	4	7	6	10	18	20	20	14	22

Suckling (1997), in his review of heronries in Surrey, commented on the intriguing fact that the majority of heronries in the county seemed to stabilize at about twenty pairs. It should be noted that the figure for 1999 was published as ten previously, the result of an earlier survey, and is now corrected.

Nightingales. Nightingales held seven territories all of which were on Western Plain. The water level in the main stream was about 2 feet (*c.*0.65 m) higher than normal on Western Plain when the species first arrived. In these flooded conditions two males took up territory up the hill just below Hill House Wood but did not persist there. The habitat of nightingales on Bookham Common for the four years 1996–9 has been analysed by the author. In those years there were thirty-three breeding attemps in eighteen territories; the analysis of the habitat in scrub is presented in a forthcoming paper (Prowse 2001), with details of conservation at Bookham and its relevance for other sites.

Turtle doves. There were about six pairs of turtle doves. One pair was known on Central Plain and the Isle of Wight (CP). The others were on a limited area of Western Plain only. In the author's experience the species likes to perch above the breeding habitat. At Bookham, and at other habitats such as Stodmarsh in Kent, the species uses branches of dead trees for singing, and sunning, and the pair will rest there. Where there are no such perches, as at Rye Harbour, and in the Algarve in Portugal, the species uses telephone cables crossing the area for the same purpose. The removal of dead trees has resulted in the loss of such perches on many areas of the plains at Bookham, and this has coincided with a loss of nesting turtle doves in those areas. On Western Plain in 2000, one dead tree was used by one pair, and dying branches on one deteriorating pedunculate oak served that purpose for another. It has been suggested to the Warden that some standards are ringed instead of removed in conservation work, in case this is a previously unidentified requirement of the species. As turtle doves in England may feed as much as six kilometres from the nesting site (Calladine et al. 1997), conservation of the nesting area does not necessarily depend on local food supply.

Concern has been expressed in the United States regarding adverse impact of the collared dove on native doves. There were three collared dove territories on the southern edge of the plains in their usual area, and one on the Isle of Wight for the first time, but there is little expectation of impact by this species on the turtle dove.

Other species of conservation concern. Marsh tits had four known territories, but many of their usual haunts in the woodland were not explored. The bullfinch had seven known pairs on the plains, the song thrush eight. No grasshopper warblers were recorded during the year. The small house sparrow populations on the edge of the common have disappeared, and the reed bunting no longer breeds.

An excess of crows. On a newly ploughed field next to Kelsey's Wood on 24 March about 170 crows were feeding, about half of which were jackdaws and the rest carrion crows. At this date breeding pairs of carrion crows are in their territories, so these were non-breeding birds. Scores of non-breeders are regularly found in some areas (Beddington sewage farm and the beach at West Worthing come immediately to mind) but this has not previously been a feature at Bookham. Picozzi (1975) recorded 50–75 per cent of carrion crows as non-breeders in different years in Scotland. There is certainly a very large surplus of the species now in the Bookham area. The London population increased by 39 per cent in the years 1994–9, and by 45 per cent in south-east England in the same time (Noble et al. 2000).

Warbler biomass. There have been significant changes in breeding populations of the five main warbler species on the plains in the last few years. The total has remained fairly constant in the years 1997–2000 varying between 97 and 120 pairs (Table 1). The changes in the relative proportions between the species is examined (Figure 1). It will be noted from the pie-charts for the four years that the changes are progressive.

The three *Sylvia* warblers, blackcap, garden warbler and whitethroat, increased from 55.5 per cent in 1997 to 74.9 per cent of the total in 2000. Surprisingly, it is the first two, woodland and woodland-edge species, which have benefited most from the plains clearance.

TABLE 1. Numbers of territories of five species of warbler on the plains of Bookham Common for the years 1997–2000.

	Whitethroat	Garden warbler	Blackcap	Willow warbler	Chiffchaff	Total
1997	28	14	12	36	7	97
1998	35	19	27	29	10	120
1999	33	24	23	26	10	116
2000	30	23	25	15	11	104

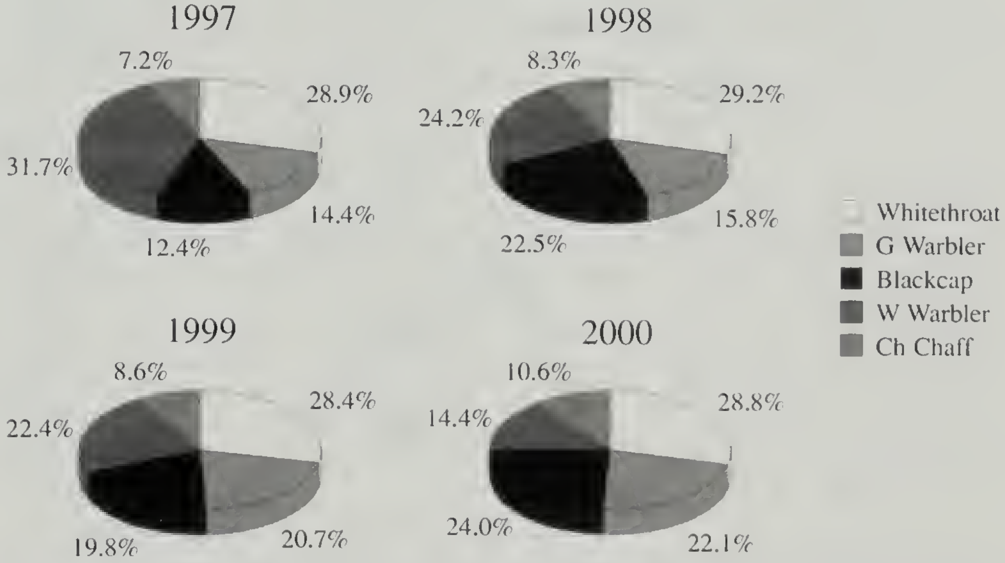

FIGURE 1. Territories of five species of warbler on the plains of Bookham Common, 1997–2000 analysed as percentage of the yearly total.

The two *Phylloscopi*, chiffchaff and willow warbler, almost halved their share of the warbler biomass in this time. They also differed markedly from each other. The woodland species, the chiffchaff, kept its numbers constant despite the clearing of much secondary storey from the wooded borders of the plains, and the taking down of standards in the more open areas. The willow warbler, however, has had a marked drop in numbers, though many of the cleared areas look ideal for it, and indeed were in 1997. The willow warbler territories in 1997 and 2000 are shown (Figure 2). The decrease from 1997 to 2000 is in all areas, whether subject to clearance or not. Moreover, it is not the result of grazing as previously suggested (Prowse 2000) since grazing is only to the south of Banks Path. The figure also shows a movement away from the edges (which are wooded).

There were records of migrant lesser whitethroats in four areas in 2000 from 29 April to 6 May but none nested.

Winter. There is little previous information on the birds in winter. The author has set up two standard walks during the winter of 2000/1. One observer is known to have made fairly regular standard walks for some years but no information has been received from these. The following is brief information from walks in the late months of the year on the plains and in South-East Wood.

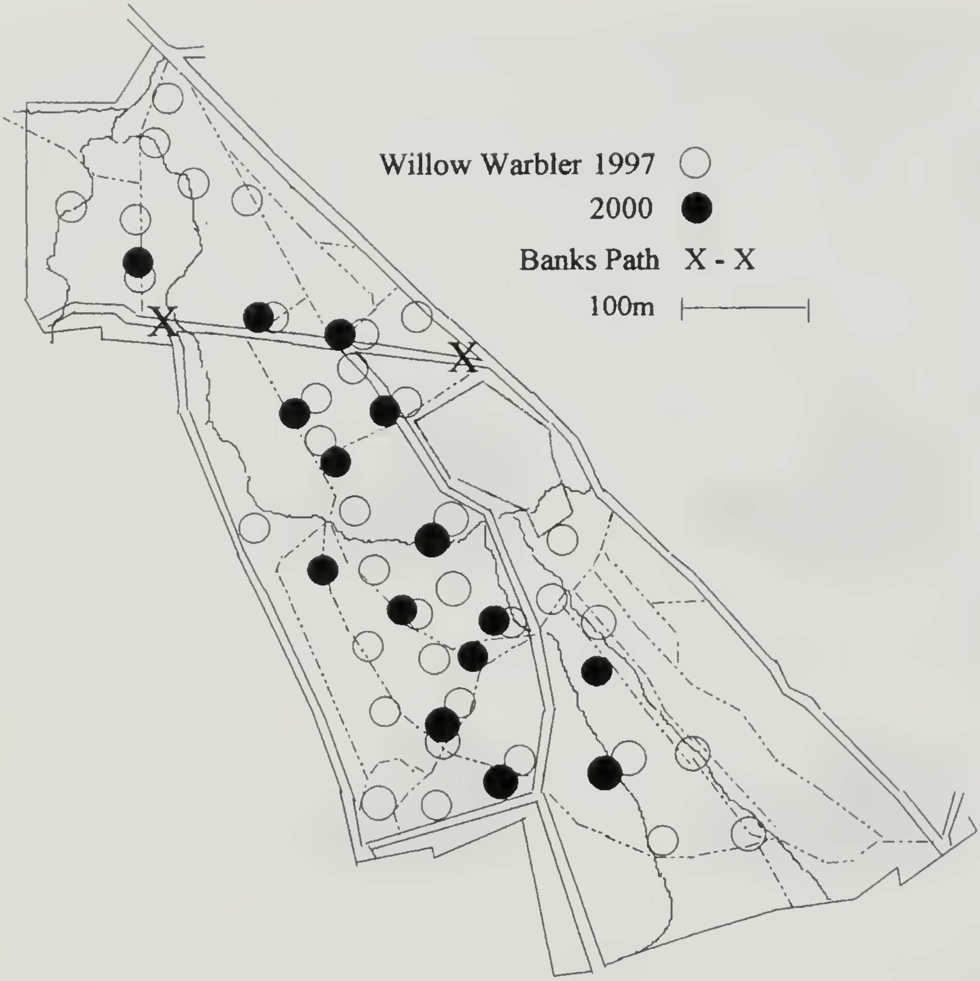

FIGURE 2. Willow warbler territories on Bookham Common plains for the years 1997 and 2000.

Thrushes: redwings — in parties of up to twenty; fieldfares — singles only; blackbirds — frequent; song thrushes — several.

Finches: chaffinches — present; goldfinches — in very small numbers, often singly; greenfinches — occasional only; bullfinch — pairs up to five contacts in a standard walk.

Tits and their allies: blue and great tits — common; marsh tit — present with up to two contacts on standard walk; long-tailed tit — recorded with up to five contacts with parties in standard walk; goldcrests — several contacts on every walk.

Further reading. Students of the bird life of Bookham Common should be aware of a valuable paper published in the past year (Oliver 2000). This survey of Limpsfield Common contains much valuable comparison with Bookham Common, and the beneficial effects of conservation on Bookham Common birds over a long period.

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Butterflies and moths (Ken Willmott)

The new millennium saw nothing new in weather patterns. The sequence of poor spring and summer weather continued, and as a consequence butterfly populations of several species were very much depleted in numbers, as courtship and opportunities for females to deposit eggs were once again rather limited.

A sunny day in early January gave us the first sighting of the year, with yet another successfully overwintering red admiral *Vanessa atalanta* seen, north of Merritt's Cottage, at the start of Glade Path (I. Menzies, 8.i.2000). On 10 March, as spring began to make early progress with some welcome sunshine and temperatures climbing to the 60°F/15°C mark for a short period, a further red admiral was seen at its most frequently encountered spring site at the northern end of The Broadway. Sightings of successfully overwintered red admirals are becoming increasingly 'normal'.

On the same bright day eight brimstones *Gonepteryx rhamni* were also seen, several being observed on a typical linear habitat, by looking over the bridge and along the railway lines near the Tunnel Car Park, where it was not unusual to see three in one sighting. On this early date comma *Polygonia c-album* predominated the nymphalid overwintering adults, with at least ten being seen, compared to just a couple of peacocks *Inachis io*, which usually emerge in force from hibernation a little later.

Later in March, the 19th and 22nd saw mostly sunny days and although not as warm as earlier in the month, this inspired further brimstone and comma flights, with yet again two red admirals at their 'regular' Broadway territory. This seemingly 'annual' territorial area still awaits some planned 'light' thinning of oak in order to maintain the sunny patches required by red admirals in the early spring and this will also benefit the later summer species, as the shaded areas are steadily overcoming the necessary sun spots. Another species requiring spring sunshine is the orange underwing *Brephos parthenias* which was also seen on these dates.

On 13 May Ian Menzies beat a half-grown larva of the purple emperor *Apatura iris* from the lower branches of a crack willow *Salix fragilis* on the eastern side of Banks Path, between Merritt's and Banks Cottages. The larva successfully pupated on 4 June and a male emerged on 20 June.

On the same day three white-letter hairstreak *Satyrium w-album* larvae were obtained in a similar manner from sapling elms by Banks Cottage at the south end of Banks Path. Two of these were in their final instar. Also, from a recently felled oak tree, of approximately thirty feet height, eighteen half-grown larvae of the purple hairstreak *Neozephyrus quercus* were beaten from the unusually available topmost branches, indicating the preference of egglaying females for the high forest canopy. A week later the lower branches of another oak, near

Tunnel Car Park, was beaten, resulting in a much lower number of five tumbling into the beating tray (I. Menzies).

On 10 June several silver Y *Plusia gamma* were seen, and a fresh speckled wood *Pararge aegeria* observed egglaying on shaded grasses at Eastern Plain. A half grown orange tip *Anthocharis cardamines* larva was found on garlick mustard in the garden of Merritts Cottage (I. Menzies). On 13 June a Mother Shipton *Euclidia mi* was seen on Eastern Plain. The first meadow browns *Maniola jurtina* began to emerge the following day (I. Menzies).

Despite being a mostly cloudy day, 25 June saw a single white admiral *Limenitis camilla* on the wing, a dozen meadow browns, and half a dozen ringlets *Aphantopus hyperantus*. Two days later, with periods of sunshine and temperatures reaching 70°F/21°C, over twenty, mostly 'scanning' male, white admirals were busily seeking virgin females and a single silver-washed fritillary *Argynnis paphia* plus the first purple emperor sighting of the season at its Mark Oak territory.

Despite it only being a fair day, with some bright spells, 29 June was warm enough and very small numbers of both purple and white-letter hairstreaks were seen around their larval foodplants, the latter still struggling to survive the new wave of Dutch elm disease sweeping around both species of elm on the Common. Equally small numbers of small skipper *Thymelicus sylvestris* and large skipper *Ochlodes venata* were also flying on this date. Another purple emperor was seen and a female red admiral was busily laying eggs on a patch of stinging nettles. Commas seemed to be doing particularly well, despite the inclement weather, with over twenty of the new generation on the wing, already laying eggs on stinging nettle as well as one being found on wild hop. Ringlets were numerous and a female was seen to select a tussock of tufted hair grass *Deschampsia cespitosa* on which to drop her eggs.

Over a dozen small skippers were flying in a small patch 3 July and a grounded purple emperor disturbed by a car on the road near Tunnel Car Park, with another being seen in flight. Once again a female red admiral was actively seeking stinging nettles for egg sites and three days later a sunny afternoon tempted at least thirty silver-washed fritillaries accompanied by white admiral and purple hairstreak, performing well among the higher branches of the oaks between Glade and High Point Paths (I. Menzies). Along Hollow Path a single male purple emperor was seen flying high over an oak, and on 8 July another was seen flying high over the oaks adjacent to Merritt's Cottage (I. Menzies).

The first gatekeepers *Pyronia tithonus*, three males, were seen 11 July and on the same day a larva of the sallow kitten *Cerura furcula* was found by chance on a small group of sallows recently felled near one of the ponds — another example of Lepidoptera doomed by felling trees in full leaf. With respect to the purple emperor, sallow cut in June or July can be left *in situ* for a period to allow pupae that might be present the opportunity to emerge successfully.

A peak of purple emperor sightings on 19 July saw four males together on the Hill House territory at 16.30 hrs. and, in the middle part of the day, three females observed egglaying on two large sallows at the junction of Glade and High Point Paths (I. Menzies). On the same day over forty silver-washed fritillaries were seen during a two-hour period, plus numerous purple hairstreaks, some flying unusually low and settling on bracken (I. Menzies).

During August a single small copper *Lycaena phlaeas* was seen on the 11th, with purple hairstreak remaining plentiful (I. Menzies). A search for white admiral larvae six days later proved very disappointing, with many negative honeysuckle sites, only two or three being found along High Point Path with young larvae.

Bookham Common did not miss out on the 2000 invasion of the clouded yellow *Colias croceus.* Half a dozen were busy feeding from the yellow flowers of fleabane on 3 September and eight freshly emerged examples were flying on Bayfield Plain on 9 September, together with a few late small coppers.

Beetles (Maxwell Barclay and Ian Menzies)

In 2000, despite the cool unsettled weather with unusually high rainfall, forty-four species of beetle new to the Common were found, and a further forty-two species with no modern (post-1970) record from the Common have been rediscovered. Of the forty-four additions, eight are given a conservation status in the 'Review of scarce and threatened Coleoptera' (Hyman 1992, 1994), and four are recent additions to the British list. The majority of the remainder are small, inconspicuous species which, although not especially uncommon, have probably been long overlooked.

Species worthy of note include *Cryptophagus labilis* Erichson (Cryptophagidae) discovered under bark (10.vi.2000, RB), which is apparently the first record of this ancient woodland species in Surrey (J. Denton pers. comm.). A sap run was found on an injured oak tree in August (MB), its presence betrayed by large numbers of hornets *Vespa crabro* Linn. that were visiting the fermenting sap. Closer examination revealed the sap-beetles *Soronia grisea* (Linn.) and *Cryptarchia strigata* (Fab.) (Nitidulidae), and the interesting staphylinid *Aleochara kamila* Likovsky. The biology of this rove-beetle is very little known, although Welch (1997) suggests that it may be associated with fungoid trees, on which it has been found on nearby Ashtead Common (Owen 1976). Welch (1997) also recommends it be upgraded in rarity status from 'notable' to RDB3.

Large water-filled ruts made by tractor wheels close to Merritt's Cottage revealed a number of interesting water beetles associated with temporary pools, including *Hydroglyphus pusillus* (Fab.)(Dytiscidae) (10.vi.2000, RB) and *Berosus signaticollis* (Charpentier) (Hydrophilidae) (30.ix.2000, MB). Around the edges of these ruts grew water purslane *Lythrum portula* (Linn.) which supported the small black and white weevil *Nanophyes gracilis* Redtenbacher (Nanophyidae) (30.ix.2000, MB), a *Red Data Book* species that is well established on the Common.

A vacuum sampler, converted from a petrol-powered garden vacuum, was used by a group including IM, MB, JM, JP and a visiting Serbian weevil expert, Snejana Pesic. This generated a large number of records including the only recent Surrey finding of the very elusive semi-aquatic weevil *Bagous lutulosus* (Gyllenhal) (30.ix.2000) (Curculionidae). JP also recorded the anthribid (fungus weevil) *Platystomos albinus* (Linn.) (19.viii.2000) which flew onto him from Bayfield Plain, this being the second record of this uncommon species for the Common.

Investigation of dung was also fruitful, producing the striking histerid *Onthophilus striatus* (Forster) (11.iii.2000, RB) and three scarab beetles previously unknown from the Common, *Aphodius consputus* (Panzer) (14.xi.2000, JM & PF), *A. foetidus* (Herbst) (11.iii.2000, RB) and *A. borealis* Gyllenhal (30.ix.2000, DM & DN). *A. consputus* is a Red Data, winter active, species only known in Surrey from Richmond Park and Box Hill (D. J. Mann pers. comm.). This brings the Bookham Common list for the genus *Aphodius* to 22, more than half the British species in this genus.

Among interesting species recorded by general collecting was the small, mottled *Bruchidius varius* (Olivier) (Chrysomelidae) (31.v.2000, MB), a species first collected in Britain in 1994 (Hodge 1996), but spreading rapidly (Cox 2001). Another newcomer to Britain to reach the Common was the rosemary beetle *Chrysolina americana* (Linn.) (Chrysomelidae), a beautiful rainbow-coloured leaf beetle brought to Ian Menzies by the Warden Ian Swinney who found it on the window sill at Merritt's Cottage. This species, which was first observed breeding by the Shell Building in London (Menzies 1999), is to be found on rosemary and lavender, but a brief examination of lavender plants in Ian Swinney's garden produced no further specimens. The small spiny weevil *Zacladus exiguus* (Olivier), associated with wild geranium, was also recorded on the Common for the first time this year (31.v.2000, MB; 14.vi.2000, CL). Several examples of the reed beetle *Donacia vulgaris* Zschach were found on leaves of reed mace *Typha latifolia* Linn. at the margin of Lower Eastern Pond (13.vi.2000, IM). Although well established not far away at Bolder Mere (Menzies and Cox 1996) the only previous Bookham record was that of a single specimen swept by F.J. Coulson more than seventy years ago (23.v.1930)!

In an attempt to record carrion-feeding beetles, three 'carrion traps' were improvised from empty plastic water bottles cut in half, filled with raw chicken bones and skin, and hung in oak trees around the Common (MB). These were left from 19.viii. to 13.ix.2000 and found to attract large numbers of burying beetles (*Nicrophorus,* Silphidae). These beetles bury small dead animals, and use the decomposing meat to feed their larvae. The traps contained 501 specimens of the very common red and black *Nicrophorus vespilloides* Herbst, sixty-one specimens of the large black *Nicrophorus humator* (Gleditsch), and only two of the rare and notable *Nicrophorus interruptus* Stephens, which was new to the Common list. Most of the beetles were still alive, and were counted off into dense foliage. Unfortunately they had eaten or damaged many of the potentially more interesting small beetles that were also attracted to the carrion.

The list of Bookham beetle species is still growing rapidly. In a single afternoon (27.x.2000), for instance Roger Booth, recorded over forty species of small Coleoptera in grass tussocks, including ten never previously recorded at Bookham, and six first post-1970 records. Several very common, conspicuous and widespread species which have probably been overlooked by coleopterists at Bookham for more than a hundred years were also added this year. These included species such as *Oedemera nobilis* (Scopoli) (Oedemeridae) (10 vi.2000, RB; 21.vi.2000, JH) and *Malachius viridis* Fab. (Melyridae) (31.v.2000, JH).

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TABLE 1. Species new to the Bookham Common list recorded in 2000 (first record only). Taxa in systematic order, initials of collectors as in text.

Species	**Date**	**Collector**
Carabidae		
Leistus rufomarginatus (Dufts.)	13.ix.2000	MB
Platyderus ruficollis (Marsham)	13.ix.2000	MB
Amara familiaris Dufts.	30.iv.2000	DP
Amara lunicollis Schiodte	31.v.2000	MB
Dytiscidae		
Hydroglyphus pusillus (Fab.)	10.vi.2000	RB
Hydrophilidae		
Helophorus minutus Fab.	10.vi.2000	RB
Anacaena lutescens (Stephens)	10.vi.2000	RB
Histeridae		
Gnathoncus nannetensis (Marseul)	13.ix.2000	MB
Onthophilus striatus (Forst.)	11.iii.2000	RB
Hister unicolor Linn.	19.viii.2000	JM
Ptilidae		
Acrotrichis atomaria (Degeer)	27.x.2000	RB
Silphidae		
Nicrophorus interruptus Steph.	13.ix.2000	MB
Scydmaenidae		
Neuraphes elongatulus (M & K)	27.x.2000	RB
Staphylinidae		
Metopsia retusa (Steph.)	19.viii.2000	MB
Stenus brunnipes Steph.	27.x.2000	RB
Stenus fulvicornis Steph.	30.ix.2000	MB
Euaesthetus ruficapillus Bois.& Lac.	13.ix.2000	MB
Quedius fuliginosus s.s. (Gravenhorst)	30.ix.2000	MB
Tachyporus atriceps Stephens	27.x.2000	RB
Tachyporus chrysomelinus s.s. (Linn.)	27.x.2000	RB
Tachyporus obtusus (Linn.)	21.vi.2000	JH
Myllaena brevicornis (Matthews)	27.x.2000	RB
Aloconota gregaria (Baudi)	12.iii.2000	DP
Atheta canescens (Sharp)	27.x.2000	RB
Atheta gagatina (Baudi)	10.vi.2000	RB
Atheta nigra (Kraatz)	11.iii.2000	RB
Atheta sordidula (Erichson)	12.iii.2000	DP
Drusilla canaliculata (Fab.)	30.ix.2000	MB
Meotica apicalis Benick	27.x.2000	RB
Deubelia picina (Aube)	27.x.2000	RB
Oxypoda elongatula Aube	27.x.2000	RB
Aleochara kamila Likovsky	19.vii.2000	MB
Scarabaeidae		
Aphodius borealis Gyllenhal	30.ix.2000	DM & DN
Aphodius consputus (Panzer)	14.xi.2000	JM & PF
Aphodius foetidus (Herbst)	11.iii.2000	RB
Cantharidae		
Cantharis cryptica Ashe	31.v.2000	MB
Melyridae		
Malachius viridis Fab.	31.v.2000	JH
Nitidulidae		
Cryptarcha strigata Fab.	3.viii.2000	MB
Soronia grisea (Linn.)	3.viii.2000	MB
Cryptophagidae		
Cryptophagus labilis Erichson	10.vi.2000	RB
Oedemeridae		
Oedemera nobilis (Scopoli)	10.vi.2000	RB
Chrysomelidae		
Bruchidius varius (Olivier)	31.v.2000	MB
Chrysolina americana (Linn.)	1.v.2000	IS
Curculionidae		
Zacladus exiguus (Olivier)	31.v.2000	MB

Bush-crickets and grasshoppers Field Day, 12 August 2000

(Ian Menzies)

A group of eleven took part in this meeting on 12 August, a very hot, cloudless day. Most of the familiar Bookham Common species of bush-cricket were either seen, or heard, with the aid of a bat-detector. Although the long-winged cone-head *Conocephalus discolor*, was plentiful in most of the grassy areas we were unable to detect the short-winged *C. dorsalis* for a third consecutive year. The latter species, established in at least four different areas prior to 1996, retracted to a single site on Western Plain during 1996–7 and has not been detected since. Disappearance of *C. dorsalis*, which favours more marshy locations than *C. discolor*, could have been due to the series of hot dry summers with unusually low rainfall. Failure to respond to a considerable increase in rainfall during the last three years, however, favours an alternative explanation, for instance an incompatibility with *C. discolor*, which first appeared on the Common in 1991 and has since undergone an extraordinary increase in the grassy areas previously inhabited by *C. dorsalis*.

Also of interest was the conspicuous reduction this year in the common green grasshopper *Omocestus viridulus*, a species which is usually quite plentiful. None was seen and the stridulation was detected on only one occasion (Gavin Hawgood). The party admired a fully grown larva of the sycamore moth *Apatele aceris* that was beaten from a small oak on Bayfield Plain. This is a particularly pretty caterpillar which looks like a small flower as it rests head-to-tail displaying orange and yellow petal-like tufts of hair.

Towards the end of the afternoon the party visited Wisley and Fairmile Commons where the bog bush-cricket *Metrioptera brachyptera*, wood cricket *Nemobius sylvestris* (Wisley), mottled grasshopper *Myrmeleotettix maculatus* (Fairmile) and stripe-winged grasshopper *Stenobothrus lineatus* (Fairmile) — all absent from Bookham Common — were found. A colony of short-winged coneheads was thriving in tufts of grass and *Juncus* at a pond margin on Wisley Common. Finally, an adult bryony ladybird *Henosepilachna argus* was discovered on white bryony growing over gorse by the side of the A3 at Fairmile Common. This is a handsome apricot-coloured ladybird with eleven black elytral spots, well established in Southern Europe, which has recently been recorded from Molesey (Menzies and Spooner 2000) and is evidently spreading its range here.

Reference

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Results of a five-year study of leaf miners (Diptera: Agromyzidae) on Bookham Common

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Summary 193
Introduction 193
Review of the literature 193
Choosing samples 196
Results 197
Conclusions 201
Acknowledgements 201
References 201

Summary

A five-year study of holly-leaf miners *Phytomyza ilicis* Curtis (Diptera: Agromyzidae) on Bookham Common was carried out from February 1995 to May 2000. The percentage of leaves mined from month to month was analysed and showed a range from 14.6 to 2.98 with a peak in February to March and a trough in late summer. Leaves may remain on the tree for up to five years after being mined.

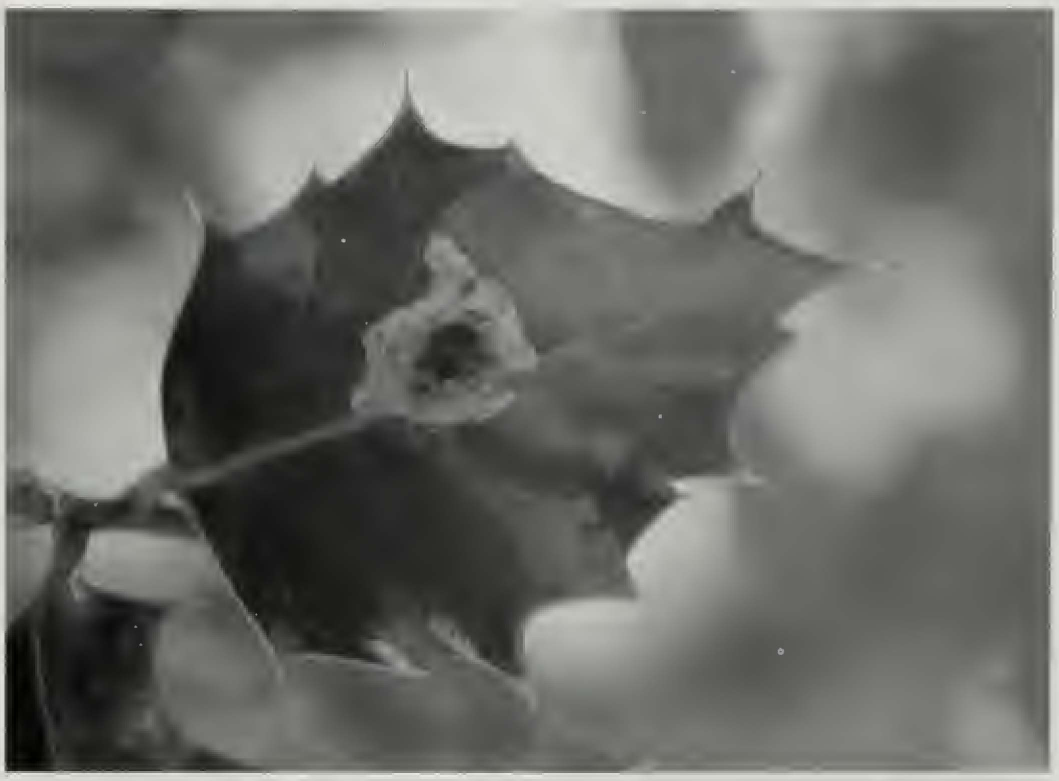
Introduction

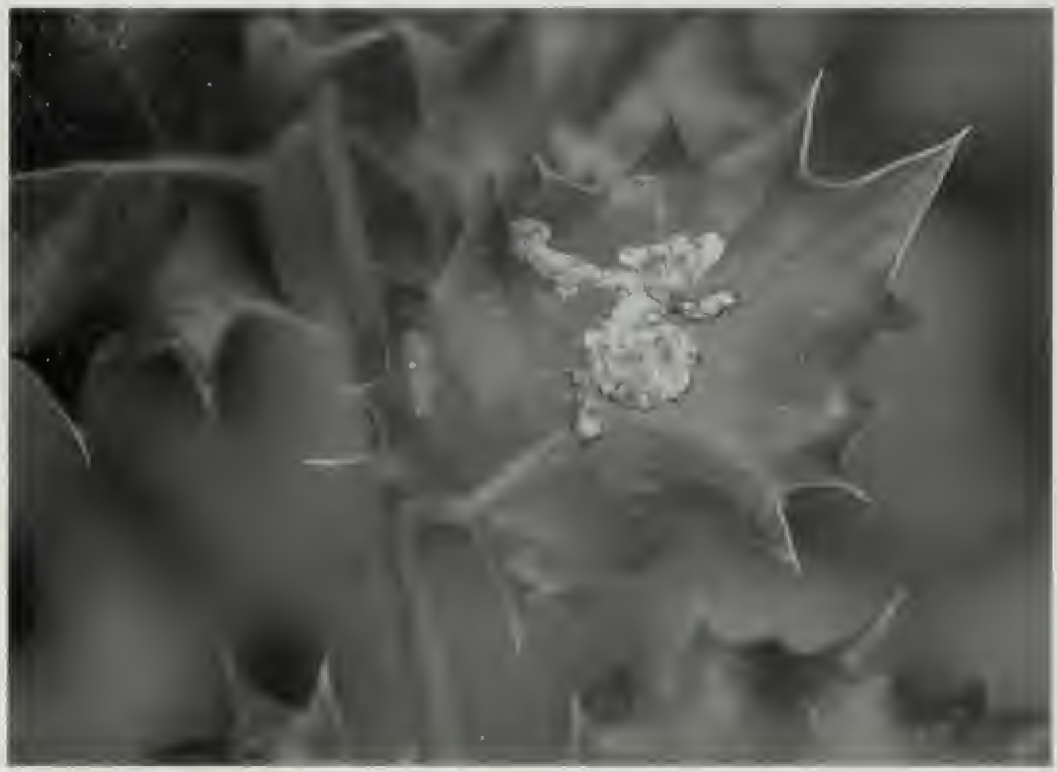
'Leaves on the holly tree which occurs commonly throughout the woodlands on Bookham Common often show heavy infestation by the Holly-leaf-miner *Phytomyza ilicis* Curtis. The presence of its larva causes an unmistakable blotch mine to form on each leaf which is infected and is easily recognisable. Choose 6 bushes, preferably by the sides of rides, and visit the same examples each month from Oct. – March. Select the same branch each time that is in easy reach and count the number of infected leaves. Does the number increase as the winter progresses? . . .' (Anon. undated).

The above quotation is taken from a list of suggested projects that was handed to us when we first visited Bookham Common in September 1994 which we considered to be within our capabilities and suited to the amount of time we had available. The following is an account of our experiences.

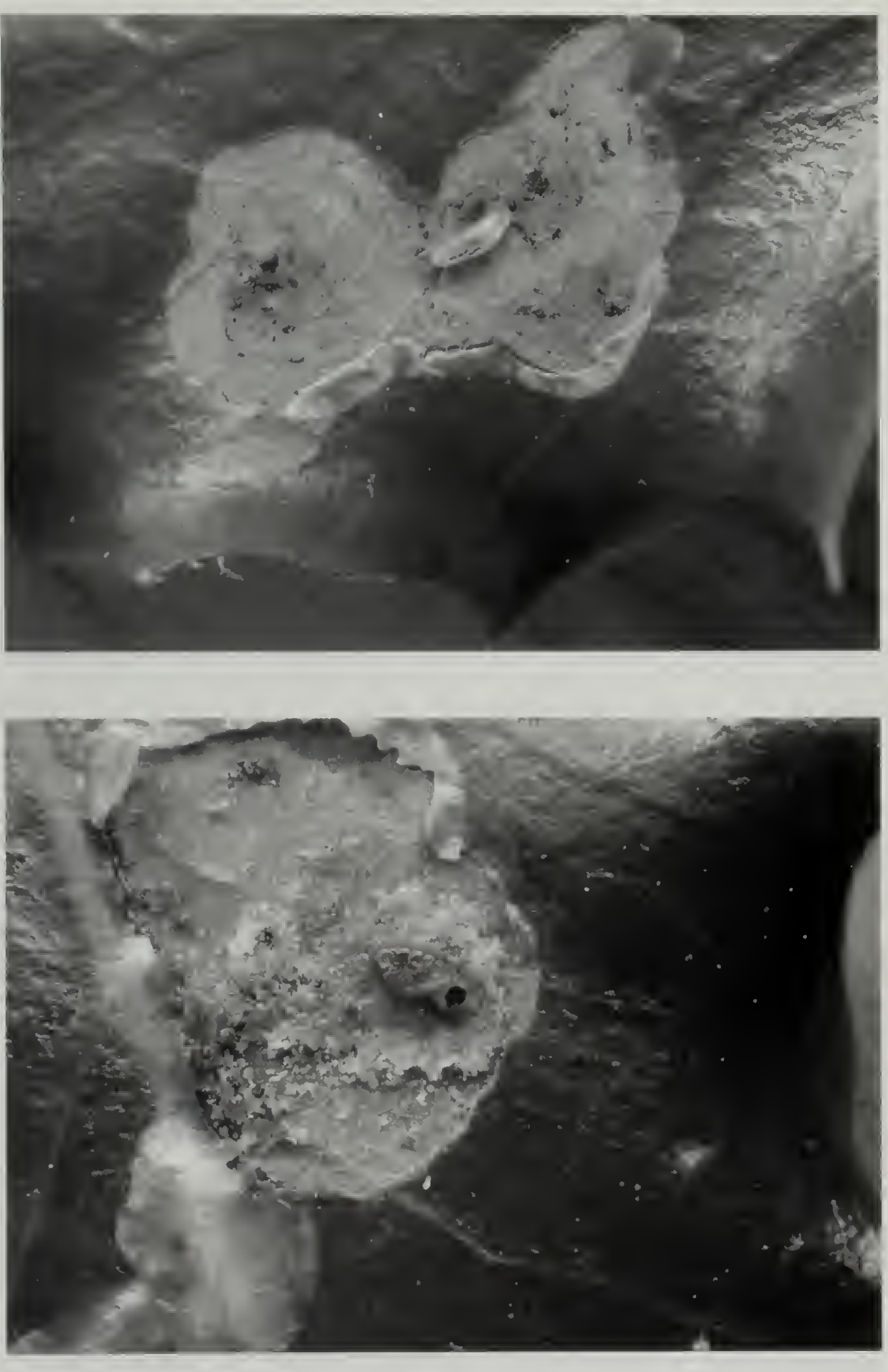
Review of the literature

The holly-leaf miner that occurs on Bookham Common, *Phytomyza ilicis,* and the only one known in Europe, was first described by Curtis (1846). The life history of the holly-leaf miner has been discussed by Miall and Taylor (1907), Downes (1931) and Cameron (1939). The eggs are laid on the lower surface of the leaves in early June, generally near the midrib and towards the base. At first the larva feeds along the central vessel of the midrib making its way towards the apex. After two months or so it moves out to the leaf blade and starts feeding on the palisade parenchyma. At this stage the mines start to become more apparent (Figures 1 and 2). The larva is reported to moult twice between July and March and to pass through three instars, the first lasting from July to December, the second from December to January and the third from February until pupation. Pupation takes place by early April and the adults emerge towards the end of May or in early June (Figures 3 and 4).





FIGURES 1 (upper) and 2 (lower). Two stages in the growth of leaf mines on holly, Bookham Common.



FIGURES 3 (upper) × 6 and 4 (lower) × 10. Larva and empty pupa case of *Phytomyza ilicis* on holly, Bookham Common.

Much of the published work on holly-leaf miners originates from the United States and Canada since the miners are a serious pest of the various species of holly *Ilex* that are widely cultivated in the Pacific coast states of those countries. Downes (1931) stated that up to 80 per cent of leaves can be affected, while Cameron (1939) reported that *Phytomyza ilicis* caused disfigurement of as many as 75 to 85 per cent of leaves of cultivated *Ilex aquifolium* L. annually in British Columbia. However, according to Kulp (1968) the native American holly-leaf miner *Phytomyza ilicicola* (Loew), although a serious pest of American holly *Ilex opaca* (Aiton), causes much less severe damage to English holly. The life history of leaf miners in British Columbia is similar to that in England but emergence is delayed by about a fortnight (Cameron 1939). Several other species of holly are attacked in the United States and several additional species of *Phytomyza* identified. Further species of affected holly and additional *Phytomyza* species have been reported from Japan (Frost and Sasakawa 1954).

It is possible that the activities of leaf miners may induce premature leaf fall. Owen (1978) concluded that although the total biomass consumed by holly-leaf miners is not large the effect of the larvae in distorting seasonal leaf-fall seems considerable. However, he studied a sample of only three trees in a suburban garden. The trees were of three different phenotypes with differing numbers of prickles per leaf. The period of maximum leaf fall was identical for all three, occurring in June and July. Between January and May leaf fall consisted almost exclusively of mined leaves but on one specimen fewer leaves fell in this period and the proportion of mined leaves was lower. In the course of a paper on the natural enemies of the holly-leaf miner Heads and Lawton (1983) recorded no leaf fall in one hundred mined leaves from October to January of the second year. However, as pointed out by James and Pritchard (1988) this was a small sample and the period considered was a time of year when little leaf fall takes place. These authors sampled up to nine sets of holly trees over a period of eleven years using a sample size of from 1,500 to 3,000 leaves and concluded that mining does increase the probability of leaf fall. Parasites of the holly-leaf miner larva include wasps such as several members of the chalcid group and at least one braconid. Other enemies include birds such as blue tits.

Owen (1978) reported that holly leaves could remain on the trees for up to four years. Other authors (Peterken and Lloyd 1967) have recorded that leaves may remain on the tree for up to eight years. Owen found that leaf miners had a considerable effect on leaf fall (see below). Peterken and Lloyd report that first-year leaves are shed in large numbers in winter, probably in response to drought, and that leaves may fall in response to frost damage. When discussing life span they do not mention that the leaves were in any way unhealthy, so their figure is presumably for healthy leaves.

Pritchard and James (1984) studied the effect of a number of factors, in particular the activities of leaf-mining insects, on the longevity of beech *Fagus sylvatica* and evergreen (holm) oak *Quercus ilex* leaves. They found that the pattern of leaf fall could be explained by within tree variation in the distribution of mines and the timing of leaf fall. They also observed that the longevity of beech leaves is to some extent related to the height of the leaf in the tree with leaves high in the canopy more likely to fall. They considered that their results could explain earlier claims, including those of Owen (1978), that mined leaves are shed earlier than unmined leaves.

Choosing samples

Before starting the survey we gave some thought to the factors that might influence the egg-laying habits of the holly-leaf miner. How many areas of the Common should or could we cover? How many trees per area? How should we choose the trees?

We decided to select two trees in each of three adjacent areas, N, T and S on the Bookham Common map (Sandford 1975 and later revisions). The time taken to count the leaves and walk from site to site should not exceed two hours each month.

As a preliminary it was necessary to consider hollies in general. A walk around the Common indicated that area N had a far greater density than either S or T, the last having the smallest number. Most of the trees seemed to be distributed in clumps, usually consisting of a central older tree surrounded by younger bushes. Hollies may spread by suckering from the roots or, more rarely, by layering from branches that touch the ground so that clumps may often be all of the same sex (Peterken and Lloyd 1967).

As it seemed possible that the height of the leaf above ground and the direction in which it was facing might affect the distributions of the mines we spent one visit examining twenty-four clumps of trees. According to Peterken and Lloyd (1967) leaves in shade tend to be thinner and larger in area than those in better lit positions, and branches in shade tend to produce fewer side twigs and the internodes tend to be longer than those of unshaded twigs. In our preliminary survey we considered the possibility that shade might have an effect on mine density but did not notice any effect. This might form the subject of further study.

However, we restricted our observations to what could be seen from ground level as we did not have access to the upper levels of really high trees. The clumps of hollies in areas N and T seemed to be more heavily mined than those in area S, so we decided to try to choose branches with different levels of infestation as a starting point; one heavily mined, one medium, two light, one very light and one completely clear. This last requirement proved difficult and, although the initial count showed the chosen branch to be apparently clear, one mined leaf was found the following month. We decided to select branches with a minimum of twenty-five leaves. It was essential that the leaves to be counted should be easily identifiable so at the start of the survey we marked the six chosen branches with a piece of blue plastic-coated wire. Although the chosen branches were fairly close to the paths, brambles, nettles and bracken proved formidable barriers when it came to reaching them during the summer months. The variation in summer and winter vegetation on the Common is quite remarkable.

Results

We started the actual study in February 1995. After the initial count we noted the number of leaves lost or gained each month. Table 1 summarizes our results. Between September and May leaf loss and gain was negligible. In December of the first year we discovered that one branch had been cut off, probably by somebody seeking Christmas decorations as it had been well endowed with berries. For the second year of the survey we selected a replacement branch on a nearby tree. This accounts for the column headed 'Pre-study Year 2' in the tables for year 2 onward. The tables show that by the end of the year, with the exception of year 3, the total number of leaves on the branches had increased in comparison with the number present at the beginning. In February of year 3 the total was down by thirty-two leaves compared with the previous March. The reason for the decrease was the loss from one specimen of three side branches bearing forty-three leaves. As with the branch lost in year 1 this again occurred in December and probably for the same reason. On this occasion we decided against choosing a replacement.

It can be seen that in each year the total number of leaves peaked in June or July. This is a net increase and disguises the fact that many leaves fall during the late spring and early summer.

Years 4 and 5 were apparently poor years for the holly-leaf miner as few new mines were recorded. We have not included a table for year 6 as we decided to terminate the study after the remaining leaves from year 1 fell in May and June of that year. Only one further new mine was found after February in year 6 bringing the total to eight.

TABLE 1. Summary of results throughout the five years of study.

1995/6 (Year 1)

	No. of mined leaves		Total	Total leaves	Percentage
Month	**Pre-study**	**New**	**mined leaves**	**on branch**	**mined**
Mar.	25	–	25	201	12.44
Apr.	24	–	24	204	11.76
May	24	–	24	204	11.76
June	22	–	22	295	7.46
July	17	–	17	266	6.39
Aug.	15	1	16	257	6.23
Sep.	15	2	17	258	6.59
Oct.	15	2	17	260	6.54
Nov.	15	4	19	259	7.34
Dec.	15	15	30	258	11.63
Jan.	15	18	33	258	12.79
Feb.	14	18	32	258	12.40

Due to complete loss of the branch under study Site 1 has not been included in above figures.

1996/7 (Year 2)

		No. of mined leaves					
	Pre-study	**Pre-study**	**New**	**New**	**Total**	**Total leaves**	**Percentage**
Month	**Year 1**	**Year 2***	**Year 1**	**Year 2**	**mined leaves**	**on branch**	**mined**
Mar.	14	10	19	–	43	315	13.65
Apr.	14	9	19	–	42	314	13.38
May	14	9	18	–	41	313	13.10
June	8	3	17	–	28	410	6.83
July	5	3	15	–	23	386	5.96
Aug.	5	3	15	–	23	379	6.07
Sep.	5	2	15	–	22	378	5.82
Oct.	5	2	14	8	29	378	7.67
Nov.	5	2	13	9	29	378	7.67
Dec.	5	2	13	15	35	377	9.28
Jan.	5	2	13	28	48	377	12.73
Feb.	5	2	13	32	52	376	13.83

*This is a replacement for branch lost at Site 1.

1997/8 (Year 3)

	No. of mined leaves							
Month	Pre-study Year 1	Pre-study Year 2	Mined Year 1	Mined Year 2	Mined Year 3	Total mined leaves	Total leaves on branch	Percentage mined
Mar.	5	2	13	32	–	52	373	13.94
Apr.	5	2	13	32	–	52	367	14.17
May	5	1	12	29	–	47	355	13.24
June	4	1	8	18	–	31	412	7.52
July	2	0	8	14	–	24	397	6.05
Aug.	2	0	8	13	–	23	388	5.93
Sep.	2	0	8	13	–	23	388	5.93
Oct.	2	0	8	13	1	24	388	6.19
Nov.	2	0	8	13	1	24	388	6.19
Dec.*	2	0	8	10	9	29	345	8.41
Jan.	2	0	8	10	29	49	342	14.33
Feb.	2	0	8	10	30	50	341	14.66

*Loss due to side branch cut off.

1998/9 (Year 4)

	No. of mined leaves							
Month	Pre-study Year 1*	Mined Year 1	Mined Year 2	Mined Year 3	Mined Year 4	Total mined leaves	Total leaves on branch	Percentage mined
Mar.	2	8	10	29	–	49	340	14.41
Apr.	2	8	10	28	–	48	339	14.16
May	2	8	10	28	–	48	336	14.29
June	2	5	7	15	–	29	508	5.71
July	2	5	5	11	–	23	500	4.60
Aug.	2	5	5	11	–	23	477	4.82
Sep.	2	5	5	11	–	23	467	4.93
Oct.	2	5	5	11	–	23	462	4.98
Nov.	2	5	5	9	–	21	449	4.68
Dec.	2	5	5	9	4	25	447	5.59
Jan.	2	5	4	9	5	25	404	6.19
Feb.	2	5	4	9	5	25	404	6.19

*Pre-study year 2 column omitted as number of leaves had reduced to zero (see previous table).

1999/2000 (Year 5)

		No. of mined leaves							
Month	Pre-study Year 1	Mined Year 1	Mined Year 2	Mined Year 3	Mined Year 4	Mined Year 5	Total mined leaves	Total leaves on branch	Percentage mined
Mar.	2	5	4	9	5	–	25	402	6.22
Apr.	2	3	4	9	6	–	24	398	6.03
May	1	3	4	9	6	–	23	387	5.94
June	1	3	4	7	5	–	20	450	4.44
July	1	3	4	6	4	–	18	498	3.61
Aug.	1	3	4	6	4	–	18	484	3.72
Sep.	1	3	4	6	3	–	17	469	3.62
Oct.	0	3	4	5	2	2	16	447	3.58
Nov.	0	2	2	5	2	2	13	436	2.98
Dec.	0	2	2	5	2	4	15	436	3.44
Jan.	0	2	2	5	2	6	17	434	3.92
Feb.	0	2	2	5	2	7	18	434	4.15

The percentage of mined leaves varied over the five years from month to month with a range of 14.66 to 2.98 per cent. The proportion of mined leaves was usually lowest at the end of summer after the main period of leaf fall and gain and highest in February and March when the leaf miners were ready to pupate.

Conclusions

The leaves of the wild holly seem to be found only on the terminal areas of branches, the parts of the branches nearest the trunk usually being bare. New leaf growth and leaf fall occur mainly in June, July and August. New leaves are formed at the far end of the branches while older leaves fall predominantly from the end of the branch nearest the trunk. We can confirm that mined leaves may stay on the tree for up to five years. Others (Peterken and Lloyd 1967) have recorded that leaves may be retained for up to eight years, but that is presumably the maximum life of a healthy leaf. We have found that holly-leaf miners may lay their eggs on mature leaves as well as first-year leaves.

Second- or third-year leaves on which eggs are laid may not fall any sooner than those with no mines. These results may not be applicable to cultivars. The earliest sign of mining occurred in August and development was usually complete by March. Pritchard and James (1984) suggested, based on their work on beech and evergreen (holm) oak, that leaves high in the canopy fall earlier than those lower down and that this might explain some of the observations of earlier workers on holly leaves. Beech, being deciduous, may not be comparable with holly with respect to leaf fall. Be that as it may we found no clear effect. That might be because the hollies that we examined were part of the sheltered understorey. However we did not have direct access to the upper parts of the trees.

Acknowledgments

We would like to thank Eric Groves for help and advice in the course of this project. Also, we are grateful to an anonymous referee for constructive comments on the manuscript.

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Book review

Lichens. An illustrated guide to the British and Irish species. Frank S. Dobson. The Richmond Publishing Co. Ltd, Slough. 2001 [2000]. Fourth edition. 431 pp. £45.00 hardback, ISBN 0 85546 093 8. £30.00 softback, ISBN 0 85546 094 6.

Lichens can be difficult to identify. A hand lens and often a microscope are needed to look at them, and chemicals are used to produce colour stains in order to separate the species. Few have English names. Book shops rarely stock anything about them. Yet they are common almost everywhere and give character to the environment, making outdoor objects pleasing and venerable. They are most attractive and colourful in themselves.

Frank Dobson has now produced this important if expensive book so that lichens may be more easily identified. This is the fourth edition and the first to illustrate most in colour. It is written especially for beginners and amateurs. About 700 of the 1,700 British lichens are incorporated, including all common species. The text has the genera arranged alphabetically, with each genus being described followed by a dichotomous bracketed key to the species. These are also listed alphabetically, with a description, colour tests, and habitat, usually accompanied by a colour photograph alongside which is a distribution map based on the British Lichen Society's distribution maps scheme database at the University of Bradford, together with a number denoting its pollution tolerance. A unique feature is that the meanings of all the generic names are included. Unfortunately the authors of the species names are omitted. Useful tables are given to comparative features for species in some groups (e.g. *Alectoria* and *Bryoria*; *Peltigera*) and the generic splits in *Parmelia*, now widely used elsewhere, are listed over pages 255–257.

Most readers will want to use the keys and those to the species are excellent and easy to use. The main key to the genera is more of a problem. It starts off by being indented but then continues as fifteen pages of tables where the reader must choose between up to sixteen alternatives in one case; this is described as a 'lateral key' on the back of the book. The abbreviations may be difficult to follow until one is accustomed to them, because different substrates have similar abbreviations, 'L' for on wood for example, but 'Li' for on another lichen. The headings 'Sl' and 'Is' are not clearly explained, but refer to *soralia* and *isidia* respectively. Tut-tut, even the species keys lapse into trichotomies in *Caloplaca* and *Cladonia*, perhaps reflecting the branching of some species in the latter!

The descriptions are rather brief but concise and accurate. The photographs are good, and the colour reproduction fine, but in a few cases (e.g. *Chrysothrix candelaris, Lecanora expallens*, and *L. varia*) the lichens appear too pale. The distribution maps are especially useful but are unfortunately small so that coastal and island records can be lost in the outline. That of *Lecanora rugosella* on p. 200 shows only two dots — surely some mistake here? There are many useful line drawings even if some are a bit primitive.

Tables of seashore zonation (p. 418) and pollution scales (pp. 18–19) are given, but the references to the works where they originally appeared have unfortunately been omitted. The two pollution scales both start off with a green alga which may puzzle the novice because there is no explanation as to what plant this is. In any case *Desmococcus viridis* is a wrong name and the alga is now called *D. olivaceus.*

Interesting economic uses are detailed for *Cladonia* and *Evernia prunastri.* Errors are few. At the beginning Jeremy Gray appears as both 'Gray' and 'Grey' on the same page, and the caption at the foot of p. 58 is a delightful squiggle! The book was actually published in early January 2001 although 2000 erroneously appears on the back of the title-page. Completion was delayed because Frank spent much time and effort trying unsuccessfully to stand as an independent for the position of Mayor of London in the May 2000 elections, his name being the same as the Labour Party candidate and because he did not agree for reasons of finance that there should be a mayor at all! His local press supported him and christened him 'Superdob'. To have written, illustrated, produced, and published such a valuable lichen book is indeed super!

JACK RODNEY LAUNDON

Hampstead Heath Survey

Progress Report for 2000

General 203
Comparison of plants from 1629 and 1632 with 1997–2000 204
The wild service tree *Sorbus torminalis* 207
Algae on Hampstead Heath 212
Birds 214
Contributors' addresses 217

General (Colin Bowlt, Chairman, Hampstead Heath Survey)

The Hampstead Heath area has some of the oldest localized plant records probably in the world, certainly in Britain. John Gerard published his famous *Herball* in 1597 which provided descriptions and locations of species for the Heath. Even earlier, in 1576, Mathias de l'Obel, a Frenchman resident at Highgate, published his *Stirpium Observationes* which included a number of records of plants new to Middlesex from the Hampstead area. However the first lists of plants were made by an apothecary, Thomas Johnson, and some of his friends during organized botanical excursions to Hampstead in 1629 and 1632. These were the results of only a few days' observations and Johnson says he did not list everything found. The botanists on our Hampstead Heath Survey have been diligently searching and recording the plants of the Heath since the Survey's inception in 1996. They have during this period, of course, recorded very many more species than Johnson. Some of these have arrived since his time either as deliberate introductions or by natural spread of aliens. This arrival and disappearance of species is one of the fascinations of natural history. We can suggest reasons but seldom do we really know. Only some deliberate introductions flourish. However, comparing data, such as Johnson's with our Survey's, shows which species are still present and which have become extinct, in this case on the Heath in the last 370 years, as shown in one of the following reports.

The survey of the flora is now mapping species in each 100-m square of the Heath on the National Grid with a view to publishing a flora of the Heath to replace that published by the old GLC in 1986, which is very out of date and was not complete. The botany team was sorry to lose Tony Vaughan to Wales but the arrival of Sir Charles Willink has been a most welcome replacement.

Records require answers to the questions 'what is it?' and 'where is it?'. Determining the latter with any accuracy can often be quite difficult particularly within trees or bushes. The purchase of a GPS positioning instrument by our Society which is currently being used on our flora recording looks like being the answer to the problem.

'Seek and ye shall find' says the Gospel. There are plenty of interesting things to be found in natural history by seekers — even in such well-trodden places as the Heath as was shown by the finding by Richard Carpenter of the new-to-Britain ramshorn gall *Andricus aries* on the Heath in 1998 (Hill 2000). Now, Amanda Waterfield has discovered (20 February 2000) the microfungus *Trichomerium grandisporum* growing on holly leaves at Cohens fields on the Heath. This had previously only been found at Kew AND THE TROPICS! How did it get to the Heath?

Reference

HILL, K. 2000. Plant gall records for 1998 and 1999. *Lond. Nat.* 79: 103–109.

Comparison of plants recorded on Hampstead Heath and nearby areas by Thomas Johnson in 1629 and 1632 with those recorded by the LNHS in 1997–2000 (Barbara Villiers and Colin Bowlt)

Introduction

As is well known, a great number of botanists have recorded and documented the plants of Hampstead Heath and nearby areas since John Gerard in his 1597 *Herball.* The following is intended as a comparison of the flora recorded by Thomas Johnson on his botanical journeys in Hampstead in 1629 and 1632 (Gilmour 1972) and our own currently running Hampstead Heath Survey in 1997–2000.

Some of the Heath records may have been planted, particularly trees (although many are regenerating), but are now considered to be naturalized. Known plantings are indicated by a 'P' in the table, but recent plantings have been omitted. Bryophytes and lichens are not included.

The modern nomenclature of Professor Clive Stace (1997) has been used. It should, of course, be emphasised that one cannot always be certain that plants are the same due to the obvious uncertainties of translation (Gilmour 1972). Any of Johnson's records where there is reasonable doubt as to the plant he actually referred to are indicated by ? in the table. Some of the plants recorded by Johnson in what he refers to as the 'wood' when he and his friends travelled from Kentish Town to Hampstead Heath in 1629 were probably found in Ken Wood (Gilmour 1972). All the plants noted by Johnson on his journeys to and from Kentish Town are included here and not just those from 'the Heath proper', which was only part of the area now known as Hampstead Heath.

Loss of species (CB)

The loss of native species with time from particular known areas is of considerable interest (Kent 1975, Rackham 1980, Bowlt and Bowlt 2000, Preston 2000). Although the list of plants recorded by Johnson in the Hampstead Heath area can only have been a sample of the plants there in the first half of the seventeenth century it nevertheless allows a rare estimate of the rate of extinction of plant species there since his time.

Johnson recorded a total of 129 species in his Hampstead lists of 1629 and 1632. Of these, the recent careful survey refound 72 species. Assuming Johnson's list was a more or less random sample the results suggest that some 44 per cent (57 of 129 species) of the native flora of the Heath area has been lost in the last 370 years. For the British Isles as a whole it is estimated that about one per cent of flowering plants and ferns have been lost in the last 300 years (Rackham 1980). Using historical records Preston (2000) showed that the counties of Middlesex and Cambridgeshire have lost 18 per cent and 13 per cent respectively of their native vascular plant species through extinction. From a similar analysis of plants recorded by Blackstone in the parish of Harefield, Middlesex during the first half of the eighteenth century, Bowlt and Bowlt (2000) concluded that 26 per cent of plants had become extinct in the intervening years.

These figures taken with those presented here for Hampstead well illustrate the greater vulnerability of smaller populations. In addition, however, the very large percentage of extinctions of the native flora, (43 per cent) in the Hampstead Heath area, compared with other places must be due to its proximity to London with its concomitant greater human pressure.

Species recorded by Thomas Johnson 1629 and 1632, and the LNHS 1997–2000.

Key × recorded by LNHS
P known planting
? doubt as to identity of plant recorded by T. Johnson

1629 and 1632	**1997–2000**
Ajuga reptans bugle	×
Alliaria petiolata garlic mustard	×
Anemone nemorosa wood anemone	×
Angelica sylvestris wild angelica	×
Anthriscus caucalis bur chervil	×
Arenaria serpyllifolia thyme-leaved sandwort	
Arum maculatum lords-and-ladies	×
Atriplex patula common orache	×
Atriplex prostrata spear-leaved orache	×
Barbarea vulgaris winter-cress	×
Betula pubescens downy birch	×
Bidens tripartita trifid bur-marigold	×
Blechnum spicant hard-fern	×
Brachypodium sylvaticum false brome	×
Briza media quaking grass	
Calluna vulgaris heather	×P
Caltha palustris marsh marigold	×
Calystegia sepium hedge bindweed	×
Cardamine pratensis cuckoo flower	×
Carex caryophyllea spring sedge	
Carex otrubae false fox-sedge	
Carpinus betulus hornbeam	×
Chenopodium bonus-henricus Good King Henry	
Chenopodium rubrum red goosefoot	×
Chenopodium vulvaria stinking goosefoot	
Cirsium dissectum meadow thistle	
Conopodium majus pignut	×
Convallaria majalis lily-of-the-valley	×P
Corylus avellana hazel	×
Crataegus monogyna hawthorn	×
Crataegus laevigata midland hawthorn	×
Cruciata laevipes crosswort	
Dactylorhiza maculata heath spotted-orchid	
Digitalis purpurea foxglove	×
Diplotaxis tenuifolia perennial wall-rocket	×
Drosera rotundifolia round-leaved sundew	
Erica cinerea bell heather	×P
Erica tetralix cross-leaved heath	×P
Eriophorum angustifolium common cotton grass	
Erodium cicutarium common stork's-bill	
Erophila verna common whitlowgrass	
Euphorbia amygdaloides wood spurge	
Frangula alnus alder buckthorn	×
Fraxinus excelsior ash	×
Fumaria officinalis common fumitory	
Genista anglica petty whin	
Genista tinctoria dyer's greenweed	?

Geranium molle dove's-foot crane's-bill	×
Geranium robertianum herb-robert	×
Gnaphalium sylvaticum heath cudweed	
Hieracium sp. hawkweed	×
Hyacinthoides non-scripta bluebell	×
Hydrocotyle vulgaris marsh pennywort	
Hypericum androsaemum tutsan	×
Hypericum tetrapterum squared-stalked St John's-wort	×
Jasione montana sheep's-bit	
Juncus acutiflorus sharp-flowered rush	×
Juncus bufonius toad rush	×
Juniperus communis common juniper	×P
Lactuca serriola prickly lettuce	×
Lactuca virosa great lettuce	×
Lamiastrum galeobdolon yellow archangel	
Lathyrus linifolius. var. *montanus* bitter-vetch	
Lathyrus nissolia grass vetchling	
Ligustrum vulgare wild privet	×
Listera ovata common twayblade	
Lolium perenne perennial rye-grass	×
Luzula campestris field wood-rush	×
Lycopodium clavatum stag's-horn clubmoss	
Lysimachia nemorum yellow pimpernel	
Lysimachia nummalaria creeping jenny	
Malva moschata musk-mallow	×P
Matricaria recutita scented mayweed	×
Medicago arabica spotted medick	
Menyanthes trifoliata bogbean	×P
Mercurialis perennis dog's mercury	×
Montia fontana blinks	?
Nardus stricta mat-grass	
Orchis mascula early-purple orchid	
Orchis morio green-winged orchid	?
Ornithopus perpusillus birds-foot	×
Orobanche rapum-genistae greater broomrape	
Osmunda regalis royal fern	×P
Oxalis acetosella wood-sorrel	
Pedicularis sylvatica lousewort	
Poa pratensis smooth meadow-grass	×
Populus tremula aspen	×
Potamogeton natans broad-leaved pondweed	×
Potentilla erecta tormentil	×
Primula veris cowslip	×P
Primula vulgaris primrose	×P
Prunus domestica wild plum	×
Prunus spinosa blackthorn	×
Pulicaria vulgaris small fleabane	
Quercus robur pedunculate oak	×
Ranunculus bulbosus bulbous buttercup	×
Ranunculus ficaria lesser celandine	×
Ranunculus flammula lesser spearwort	×
Ranunculus hederaceus ivy-leaved crowfoot	
Ranunculus peltatus pond water-crowfoot	
Ranunculus sceleratus celery-leaved buttercup	×
Rosa canina dog-rose	×
Rosa pimpinellifolia burnet rose	
Rubus fruticosus agg. bramble	×

Salix caprea goat willow	×
Salix repens creeping willow	×
Salix viminalis osier	×
Sambucus nigra elder	×
Scirpus sylvaticus wood club-rush	×
Scrophularia nodosa common figwort	×
Scutellaria galericulata skullcap	×
Scutellaria minor lesser skullcap	
Serratula tinctoria saw-wort	
Silaum silaus pepper-saxifrage	
Solidago virgaurea goldenrod	
Sorbus aucuparia rowan	×
Sorbus aria agg. common whitebeam	×
Sorbus torminalis wild service tree	×
Stellaria graminea lesser stitchwort	×
Succisa pratensis devil's-bit scabious	×
Teesdalia nudicaulis shepherd's cress	?
Ulex europaeus gorse	×
Vaccinium myrtillus bilberry	
Valeriana officinalis common valerian	
Veronica hederifolia ivy-leaved speedwell	×
Veronica officinalis heath speedwell	
Veronica serpyllifolia thyme-leaved speedwell	×
Vicia hirsuta hairy tare	×
Vicia sativa common vetch	×

Acknowledgements

We would like to thank Johnnie Slattery and Margo Nagle and several other members of the Survey for many hours spent recording.

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The wild service tree *Sorbus torminalis* (Jeremy Wright)

Introduction

All wild service trees and saplings known on Hampstead Heath and Kenwood have been inspected and surveyed. Locations are shown on Figure 1, and results and data as at March 2001 given in Table 1.

Thirty-two specimens were located, comprising nineteen mature trees, twelve naturally propagated saplings and young trees, and one planted young tree.

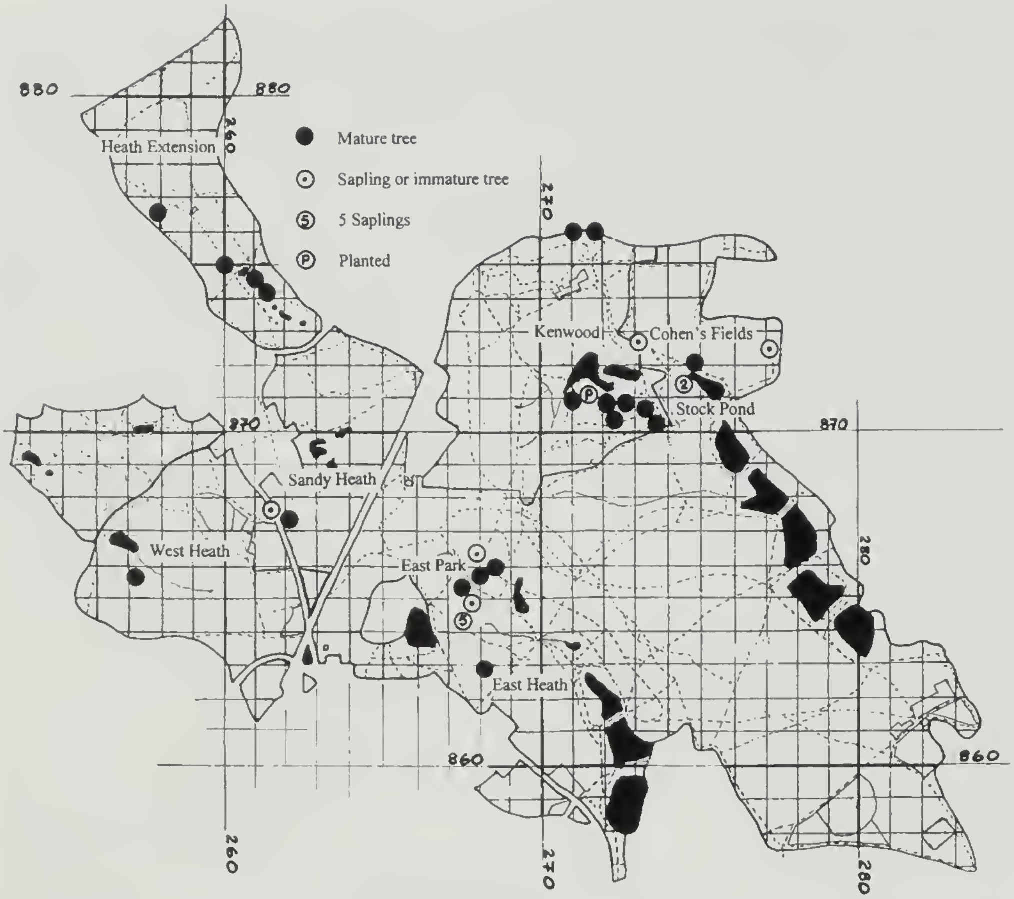

FIGURE 1. Distribution of wild service trees and saplings on Hampstead Heath and Kenwood.

Analysis and discussion

Occurrence and size. Wild service trees were first recorded on the Heath by Thomas Johnson in 1629 (Fitter 1945). Their occurrence was noted by Tansley (1913) and Watt (1913). Watt remarked (of the Hampstead district generally), that '. . . *in some places it occurs in considerable numbers, as undergrowth*'.

Harper (1981) recorded only two trees, but this was in his overview survey of two counties and was obviously incomplete. With nineteen mature trees on the 791 acres of the Heath and Kenwood, the density of one tree to 42 acres compares well with one to 103 acres for Epping Forest (61 mature trees (Lloyd 1977) in 6,300 acres). However, land use and management may have removed trees, thus affecting this distribution. Lloyd reports that at Epping Forest, the largest tree had a girth of 198 cm (0.63 m dia.) and had been pollarded, and the largest standard tree had a girth of 172 cm (0.55 m dia.). On Hampstead Heath, the two largest trees are standards, both with double trunks, and all four trunks have diameters of 0.73 m or greater.

Geology. Figure 1 shows the location of all specimens. This map was compared with the geology map of the Heath, and the soil type for each specimen was noted on Table 1. There appears to be no significant preference for Bagshot Sand, Claygate Beds, or London Clay. This contrasts with Lloyd, who found 47 out of 57 principal sites at Epping Forest were on the Claygate Beds. However, eight of the nineteen mature Heath trees are on the line of an ancient hedgerow or boundary, and it is possible that they were planted.

TABLE 1. Survey data of wild service trees and saplings on Hampstead Heath and Kenwood.

Grid Ref.	Diam.	Height	Location type	Geol.	Tree type	Lean	Dist.	Features and comments
Hampstead Heath Extension								
2579 8764	0.28/0.27/0.19	13	ancient hedgerow	L	mature	erect		2 separate trunks 1m apart, both forked. Suckers from root base
2601 8750	0.27/0.18/0.07	13	ancient hedgerow	C	mature	45°E		2 forks from base. Lower fork leaning
2612 8745	0.53	18	ancient relict hedgerow/pond	C	mature	45°W		Most northerly of 2 trees 2 m apart
2612 8745	0.51/0.24	22	ancient relict hedgerow/pond	C	mature	erect		Most southerly of 2 trees 2 m apart Forked ½ m above base
West Heath								
2574 8657	0.53	19	secondary woodland	C/B	mature	10°E		On W bank of minor N–S stream
Sandy Heath								
2621 8674	0.54	19	alongside ancient track	B	mature	erect		Single trunk
2619 8676	0.11	10	secondary woodland belt	B	immature		28	30 m W of mature tree
Kenwood								
2712 8760	0.33	11	semi-nat. ancient woodland	B	mature	20°N		Tag No. 0295
2715 8760	0.25	12	semi-nat. ancient woodland	B	mature	erect		Tag No. 0282
2711 8709	0.33/0.30	15	semi-nat. ancient woodland	C	mature	On grd		No Tag No. 2 trunks, on ground/at 10°, pointing N. Growth only at tips
2719 8709	0.09	7	semi-nat. ancient woodland	C	planted	erect		No Tag No. Adjacent to footpath
2727 8708	0.52	19	semi-nat. ancient woodland	C	mature	20°N		Tag No. 5213
2728 8708	0.48	16	semi-nat. ancient woodland	C	mature	15°N		Tag No. 5212
2727 8706	0.57	17	semi-nat. ancient woodland	C	mature	30°E		Tag No. 5208
2734 8705	0.33	15	semi-nat. ancient woodland	C	mature	erect		Tag No. 5021
2735 8703	0.43/0.27	15	semi-nat. ancient woodland	C	mature	erect		Tag No. 5129. Double trunk from 1 m, fused at 2 m, then double

Grid Ref.	Diam.	Height	Location type	Geol.	Tree type	Lean	Dist.	Features and comments
East Park								
2683 8658	0.75	20	ancient ghost hedgerow	C	mature	erect		
2681 8658	0.83/0.75	24	ancient ghost hedgerow	C	mature	erect		Double trunk from 1 m.
2678 8663	[12 mm]	2	secondary woodland/scrub	C	sapling		58	2 m N of giant oak
2677 8652	0.45	19	ancient ghost hedgerow	C/L	mature	erect		On E bank of gulley
2678 8649	[30 mm]	4	secondary woodland	C/L	sapling		32	5 m E of ancient hedgeline
2678 8644	[15 mm]	2	secondary woodland/stream	L	sapling		81	15 m E of ancient hedgeline
2678 8644	[10 mm]	1	secondary woodland/stream	L	sapling		81	15 m E of ancient hedgeline
2678 8644	[25 mm]	3	secondary woodland/stream	L	sapling		81	20 m E of ancient hedgeline
2674 8644	[20 mm]	4	secondary woodland/stream	L	sapling		85	25 m W of ancient hedgeline
2673 8644	[45 mm]	6	secondary woodland/stream	L	sapling		89	40 m W of ancient hedgeline
East Heath								
2681 8628	0.25/0.23/0.21	14	secondary copse	C	mature	10°S		3 stems. Multiple suckering around, mainly within 2 m, but up to 8 m
Cohen's Fields and Stock Pond								
2746 8714	[20 mm]	3	secondary woodland/pond	L	sapling		73	In Stock Pond enclosure
2747 8716	[80/40 mm]	9	secondary woodland/pond	L	sapling		51	In Stock Pond enclosure
2733 8727	[10 mm]	1.5	ancient relict hedgerow	C	sapling		158	1 m N of path, by dead oak monolith
2748 8721	0.80/0.73	19	ancient relict hedgerow	C/L	mature	erect		2 trunks 1m apart. Roots exposed with bracing and buttressing
2771 8725	[10 mm]	2	secondary woodland/ ancient ghost hedgerow	C	sapling		233	On ancient hedgeline, 5 m. S of ancient oak

Key to columns:
Grid Reference OS Grid to approx. 10 metres accuracy.
Diameter (equivalent) in metres.
Height approx., in metres.
Location type The most significant type/s.
Geology: B =Bagshot Sands; C = Claygate Beds; L = London Clay. When on an interface, both types are noted.
Tree type whether mature, immature, sapling (naturally propagated), or sapling/young tree (planted).
Lean of trunk in degrees from vertical, with compass direction of lean.
Distance, in metres, of sapling from nearest mature tree.
Features and comments.

Regeneration. Rackham (1995) gives 'seed' as a rare form of regeneration, and 'suckers' as a much easier form. Winter (1978) reported that a seed wasp had been found severely reducing the amount of viable seed by larvae infestation, particularly in southern England. Seedlings can occur, as in Coldfall Wood in Haringey (Wright 1997), where over a hundred seedlings occurred in a newly coppiced area, but with no seedlings recorded from the uncoppiced part of the wood. Lloyd reports that at Epping Forest, very few saplings appeared to be of seed origin. He confirmed that most originated as suckers, with the parent tree sending out a 'runner root' far beyond the spread of the tree. Distances up to 110 m have been measured.

Table 1 therefore shows the approximate distance from each of the twelve saplings and young tree, to the nearest mature tree: five are less than 80 m, three of these could be suckers, but two are across a pond and are presumably of seed origin. A further five are between 80 and 90 m away from the nearest tree. However, as they are down a steep slope, with four on the far bank of a small stream, they are probably of seed origin. The remaining two saplings, about 230 m and 160 m from the nearest tree, must also be of seed origin. It is therefore likely that nine of these twelve saplings are from seed. Surprisingly, vigorous suckering has only been noticed around two of the nineteen mature trees.

Tree growth and lean. Lloyd (1977), in his detailed study of sucker development, concludes that a sucker usually curves towards the parent tree as it comes to the surface. The resulting tree, as it develops, shows a definite lean at the base for several decimetres, and then curves upright. Trees of seed origin grow as normal upright standard trees.

No curves of this type were noticed on Hampstead Heath on the suckers of the two trees, or on the mature trees. All eight trees in ancient hedgerows had erect trunks, although two trees had double trunks or were one of an adjoining pair, with one of each pair leaning at 45 degrees. It is therefore likely that these hedgerow trees were of seed origin, naturally distributed or planted. In contrast, of nine trees in semi-natural ancient woodland or secondary woodland, five had single straight trunks leaning (not curved) at 10–30 degrees from the vertical, as shown in Table 1.

Survey methods

Grid references were determined with a Garmin GPS, and were then checked/adjusted for best fit against detailed maps. They are probably accurate to about 10 m. Equivalent diameter of trunk in metres was determined from girth at chest height (1.3 m), irrespective of cross sectional shape. Where there are multiple trunks starting above ground level, then the diameter of each is shown, e.g. 0.83/0.75 m. Twin trunks that are separate at ground level are recorded as separate trees. Sapling diameter is recorded in millimetres. Heights in metres were measured approximately with a protractor-clinometer and then by pacing. Trunk lean in degrees from vertical was measured with a protractor-clinometer, and compass direction judged from maps.

Acknowledgements

I am grateful to Matt Baker, David Bentley, Andrew Ginner, and Deborah Wolton for giving me information that enabled me to locate mature trees, and to Ralph Harmer of Forest Research for species information. I am indebted to Richard Payne and Ian Greenwood for visiting trees with me on site, and particularly to Ian for showing me all the saplings.

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Algae on Hampstead Heath (Mark Burgess)

The Heath includes just about every sort of freshwater habitat except a river. It has bodies of still fresh water, all called ponds although they range from small ponds such as the few metres wide Seven Sisters Number Three to lakes such as the Model Boat Pond (*c.* 180 × 100 metres) and include such oddities as the Brobdingnagian bird bath, the Whitestone Pond. (I take a lake to be any large body of open fresh water too deep to support the higher plants.)

The following list is from *Hampstead Heath: its geology and natural history* (Fisher Unwin 1913) and is included to make it more readily accessible. As far as I know it is the only list of algae on Hampstead Heath, unlikely though this seems.

Cyanobacteria (Cyanophyceae) (blue-green algae)
Oscillatoria

Bacillariophyceae (diatoms)
Pleurotaenium

Chlorophyceae (green algae)
Draparnaldia
Chaetophora pisiformis
Cosmarium nitidulum
Closterium: several species in Highgate ponds (e.g., *C. rostratum*)
Pandorina
Gonium pectorale
Volvox globator
Oedogonium

Chrysophyceae (golden-yellow algae)
Synura
Dinobryon

Cryptophyceae

Dinophyceae (dinoflagellates)
Peridinium

Euglenophyceae (euglenoid flagellates)
Euglena viridis

Rhodophyceae (red algae)

Xanthophyceae (yellow-green algae)

Here is my own list, with no claims to comprehensiveness or anything near it.

Cyanobacteria (Cyanophyceae) (blue-green algae)
Oscillatoria

Bacillariophyceae (diatoms)
Asterionella sp.
Asterionella formosa Hassall
Asterionella gracillima (Hantzsch) Heiberg
Asterionella bleakeleyi W. Smith (= *Bleakeleya notata* Grunow em. Van Heurck)
Diatoma vulgare Bory: a common epiphyte.
Gomphonema: as above.
Melosira
Synedra: present in the plankton of most larger ponds. *Synedra pulchella* Kützing, the commonest species.
Fragilaria
Navicula
Surirella

Chlorophyceae (green algae)
Apatococcus lobatus (Chodat) Boye Petersen: common on trees and fences throughout the Heath.
Desmococcus vulgaris (Naegeli) Brand: on trees and fences throughout the Heath. Not as common as the above (a pattern repeated throughout Britain). The two species were once confused under *Pleurococcus*; the difference between them is that *Apatococcus* does not have pyrenoids (starch test).
Chlorella: common trees and fences; also occurs in most bodies of water.
Stichococcus bacillaris Naegeli: particularly on wet, rotting logs.

Chlamydomonas
Haemococcus pluvialis Flotow: The 'bird bath'algae but often found in ponds.
Tetraëdron minimum (A. Braun) Hansgirg
Mougeotia
Microspora
Tribonema affine Kützing
Ulothrix
Cladophora glomerata Kützing: very common and widespread.
Coelastrum microporum Naegeli
Dictyosphaerium ehrenbergianum Naegeli
Pediastrum duplex Meyen
Eudorina elegans Ehrenberg
Scenedesmus obliquus (*S. acutus*) Meyen
Spirogyra: ubiquitous.
Stigeoclonium tenue Kützing: Common in spring, especially in the outfalls from the ponds.

Chrysophyceae (golden-yellow algae)
Synura uvella Ehrenberg em. Korsch: widespread, often occurring in great numbers; in the first two weeks of April 2001 the Viaduct Pond was almost a pure culture.
Dinobryon divergens Imhof: occurs in most gatherings, but rarely in any numbers.
Uroglena americana Calkins
Mallomonas acaroides Perty: when it does occur, does so in large numbers.

Dinophyceae (dinoflagellates)
Ceratium hirundinella O. F. Müller: in the larger ponds. On 31 August 1996 the Wood Pond (Kenwood) was virtually a pure culture.
Peridinium inconspicum Lemmermann
Peridinium cinctum (O. F. Müller) Ehrenberg: found in the larger ponds but uncommon; cysts of Peridinium cinctum found in April (dinoflagellate cysts are normally found in late summer/early autumn).

Euglenophyceae (euglenoid flagellates)
Phacus longicauda (Ehrenberg) Dujardin
Trachelomonas

Xanthophyceae (yellow-green algae)
Vaucheria

Charophyceae (stoneworts)
Nitella mucronata (A. Braun) Miquel: has been found in the Viaduct Pond by Dan Hackett; see Hampstead Heath Survey Newsletter January 2000. *Nitella mucronata* is a JNCC Nationally Scarce Species.

General notes

I use a plankton net with a mesh of 53 µm. The identification guides used (in order of use):

Pentecost, Allan. 1984. *Introduction to freshwater algae.* Richmond Publishing. An enthusiastic introduction with good keys.

Bellinger, E. G. 1992. *A key to common algae.* Institute of Water and Environmental Management. Best to species level; the bibliography is unusual in not citing any book by any current British phycologist. They, in turn, do not cite it.

West, G. S. and Fritsch, F. E. 1927. (Reprinted 1968 by J. Cramer.) *A treatise on the British freshwater algae.* Out of date but indispensable. Second-hand copies are fairly common at the £15 mark.

Prescott, G. W. 1978. *How to know the freshwater algae.* W. C. Brown & Co. Efficient keys; if you are faced with something which totally mystifies you, this is the one with which to start.

For those interested in beginning the study of algae:

Belcher, H. and Swale, E. 1978. A beginner's guide to freshwater algae. HMSO.

For those who want a good introduction with beautiful photographs:

Canter-Lund, Hilda and Lund, John W. G. 1995. *Freshwater algae: their microscopic world explored.* Biopress.

Notes on omissions and differences

Cyanobacteria often occur on damp soil and the soil of Hampstead Heath is often spotted with dogs' faeces, used syringe needles and other unappetizing stuff. This does not explain the paucity of planktonic forms.

Another omission is *Volvox* which occurs in almost any mesotrophic body of water and although not common, should have been found by now. This is one of the few algae visible to, and identifiable by, the naked eye.

Birds (John Barrington)

I started monitoring populations of species using the Heath in 1997, so this report gives a brief overview of the first four years' work. Two visits are made each month: one for the ponds, one for other habitats.

Ponds. Counts started in February 1997. Initially, they were restricted to the sixteen larger ponds but, since June 2000, all ponds have been included. All free-flying waterfowl and specialist waterside birds are counted. Dependent young and overflying birds are excluded. Pond counts made from April 1999 onwards have also been passed on to the BTO/WWT/RSPB/JNCC Wetland Bird Survey.

Twenty-three species were recorded during this period, with the highest total (20) in 2000. Table 1 shows the highest number of species counted on those ponds having a minimum annual mean of five species in each of the four years.

The core species (those recorded on at least 40 of the 47 visits made over the four years) are listed in Table 2, together with peak counts and total number of individuals counted. These figures suggest no clear trends, except for mute swan (increasing) and great crested grebe (decreasing).

The autumn and winter months bring in a range of opportunistic feeders, e.g. black-headed gull (peak counts over the last three years of 492, 575 and 451), grey heron (peak counts over the four years of 4, 3, 4 and 5) and cormorant (peak counts of 21, 17, 15 and 15). Since extending the counts, I have noted a flock of Canada geese regularly feeding in the early morning on grassy areas near Lily Pond (Golders Hill Park). These seem to be independent of birds using the ponds themselves (i.e. the flock total does not match the grand total for the ponds). Shoveler and pochard are regular visitors in small numbers (peak counts of 16, 11, 24 and 7 and 7, 4, 2 and 3 respectively). I have recorded gadwall once (in 1997) — given their current success in the London area, I would expect to record them more often.

Although not set up as a breeding survey, for which more visits during spring and early summer would be needed, I have been able to keep some simple statistics on nests and broods. Table 3 gives peak nest and brood counts where available. Reed warblers also nest on Bird Sanctuary Pond (singing males heard), but I have no counts for this species. Canada goose breeding is controlled. The figures for great crested grebe and mute swan are consistent with the population changes mentioned above. The little grebe nest on the same pond (Wood Pond in Kenwood) each year. Common terns are seen each year, but I have not recorded any breeding attempt since 1997.

Other habitats. Counts started in January 1997. Transects (fixed routes of about one kilometre) were walked in four parts of the Heath (covering, roughly speaking, Heath Extension, East Heath, Kenwood and West Heath). All birds within twenty-five metres either side of the route were counted. Dependent young and overflying birds were excluded.

In all, fifty species were recorded over the four years (peak counts of 38, 43, 37 and 40 respectively). Table 4 shows the highest number of species counted on each transect.

The core species (those recorded on at least forty of the forty-eight visits made over the four years) are listed in Table 5, together with peak counts and total number of individuals counted. Bearing in mind that many of these birds form flocks or parties outside the breeding season (and may therefore be off the transects during a count), these figures do not suggest any substantive changes in populations.

Like the pond counts, the transects were not set up as a breeding survey, and no data on nests or broods have been collected. However, at least twenty-one of the species not covered by the pond counts probably breed (i.e. they were recorded on at least three visits between March and June in at least one year).

Plans for 2001. The pond counts, with their recently extended coverage, give as comprehensive a picture as can be expected from a single monthly visit. Coverage of other habitats, however, could be improved. I need to widen the range of areas sampled — some (e.g. Sandy Heath and Parliament Hill Fields) fall outside the transects. Also, many species are under-represented because they fall outside the transect band. In 2001, I will switch to a single, continuous, fixed route, with the count area determined by the boundaries of the Heath.

Further information. Copies of monthly progress reports are held at the Kenwood and Lido Information Centres, and at the Survey Base on the Heath

Extension. An annual report appears as an appendix to the Hampstead Heath Ornithological Report (1997 onwards). Details are also published on my website (URL: www.johnwbar.dircon.co.uk).

Tables (see text for explanations)

TABLE 1. Highest number of species counted on selected ponds.

	1997	**1998**	**1999**	**2000**
Bird Sanctuary	7	7	7	8
Boating	10	8	8	8
Hampstead 1	11	12	13	12
Hampstead 2	9	8	8	8
Highgate 1	9	10	9	8
Men's Bathing	8	8	9	7
Wood	7	7	8	8

TABLE 2. Peak and total counts for core pond species.

	Peak counts				**Total counts**			
	1997	**1998**	**1999**	**2000**	**1997**	**1998**	**1999**	**2000**
Canada goose	34	40	38	28	277	289	249	226
Coot	71	82	80	98	669	811	822	986
Great crested grebe	10	10	6	5	76	57	31	24
Mallard	221	210	237	227	1,781	1,857	1,871	1,741
Moorhen	38	41	38	52	295	307	310	426
Mute swan	6	9	13	16	38	81	112	145
Tufted duck	90	72	79	99	550	621	698	828

TABLE 3. Peak nest and brood counts for pond species.

	Nests				**Broods**			
	1997	**1998**	**1999**	**2000**	**1997**	**1998**	**1999**	**2000**
Canada goose	2	4	4	2	0	1	1	3
Common tern	1	0	0	0				
Coot	12	11	12	14	16	12	13	6
Great crested grebe	3	2	1	1	2	3	1	0
Little grebe	1	0	0	0	0	1	1	1
Mallard					4	3	2	3
Moorhen	1	1	1	1	2	0	2	4
Mute swan	0	2	2	3	0	2	2	3
Tufted duck					1	2	3	2

TABLE 4. Highest number of species counted on transects.

	1997	**1998**	**1999**	**2000**
East Heath	13	16	17	15
Heath Extension	16	18	18	16
Kenwood	15	20	20	21
West Heath	16	15	17	16

TABLE 5. Peak and total counts for core transect species.

	Peak counts				**Total counts**			
	1997	**1998**	**1999**	**2000**	**1997**	**1998**	**1999**	**2000**
Blackbird	14	24	25	23	96	157	154	127
Blue tit	36	65	52	40	222	335	253	249
Carrion crow	38	45	51	48	279	215	252	215
Feral pigeon	41	51	45	42	251	234	241	176
Great tit	16	19	27	25	118	134	143	129
Long-tailed tit	14	16	12	19	40	54	59	65
Magpie	24	15	14	19	127	115	105	135
Nuthatch	4	6	4	6	24	32	15	28
Robin	16	37	29	26	105	185	180	181
Woodpigeon	296	113	104	64	655	367	419	247
Wren	16	20	17	14	88	93	122	94

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Book reviews

Checklist of Lepidoptera recorded from the British Isles. Second edition (revised). J. D. Bradley. September 2000. 120 pages, A4 paperback. ISBN 0 9532508 2 2. Published privately; available from D. J. Bradley, The Glen, Frogham, Fordingbridge, Hants SP6 2HS. Price £12.50 + £2 delivery.

This revised edition of the standard checklist of the species and subspecies of butterflies and moths known from Great Britain and Ireland uses the current scientific names of the taxa and is more comprehensively annotated than the 1998 edition which is now out of print. Species recently added to the British list have been included. Annotations, e.g. on foodplant(s), habitat and distribution now include an indication of the national status of species such as are already on the UK red data list or are protected or considered to be rare or scarce. References are given to first records of species newly recorded since the 1950s, including a number from the Greater London area. Scientific and English names of the taxa are indexed separately under the log book numbers used in recording.

Log book of British Lepidoptera. J. D. Bradley. May 2000. 112 pages, 112×190 mm, paperback. ISBN 0 9532508 1 4. Published privately; available from D. J. Bradley, The Glen, Frogham, Fordingbridge, Hants SP6 2HS. Price £6 (£5 to members of the LNHS) + £1.50 delivery or £1 if ordered together with checklist.

Pocket-sized and intended for in-the-field recording, the present version of the *Log book* uses the same number coding system for species as the original work (Bradley and Fletcher 1979). The nomenclature has been updated and new records added. The national status of species on the UK red data list and protected or are rare and scarce is indicated. The 2,500 and more species and subspecies or forms (not aberrations) known from Great Britain and Ireland are listed. The *Log book* complements the revised *Checklist* published in September 2000, which is indexed.

K. H. Hyatt

John Ray and his successors: the clergyman as biologist. Edited by Nigel Cooper for the John Ray Trust. 1999. 252 pp. Softback. No ISBN. Obtainable from the John Ray Trust, Town Hall Centre, Market Square, Braintree, Essex CM7 3YG. £15 post-free.

The discerning and pioneering English naturalist John Ray (1627–1705) lived at a time when great changes were taking place socially and industrially. He was one of the great British naturalists of the late seventeenth century, laying the foundation of much botanical classification, to the extent that he has been justifiably called the 'English Linnaeus'. This book is the result of invited contributions to a joint conference on the work of Ray and later clergyman-naturalists, hosted by the John Ray Trust in Braintree in March 1999.

Following the introductory chapter 'John Ray, Father of Natural Historians', we have eighteen chapters detailing the lives of clergyman-biologists and their contributions to scientific, philological and religious learning. Parson-naturalists long played a respected role in English scientific culture, but there are, understandably, gaps. There is no mention of ornithological or arachnological parsons who did much to improve our knowledge of British natural history, whilst Gilbert White, about whom much is already written, is, reasonably, not included, though his youngest brother, The Rev'd Henry White, on whom much less is written, is accorded a short chapter.

The John Ray Trust is to be commended for producing this interesting volume which will take its place alongside standard biographies documenting the development of the study of British natural history.

K. H. Hyatt

Botanical records for 2000

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Abstract

A selection of records of vascular plants in the London Area is presented. They include *Geranium purpureum* new to Essex and London, *Scleranthus annuus* subsp. *polycarpos* new to Surrey and the London Area, *Eleocharis uniglumis* new to Essex, and a number of novel casual aliens.

Introduction

This paper continues an annual sequence started by Lousley with 'Botanical records for 1943 and 1944', containing selected records from a region approximating to a circle of radius 32 kilometres, centred on St Paul's Cathedral ('the London Area'). The records are in a standard sequence based on the division of Britain into 'vice-counties' devised by Watson (1873). The London Area contains substantial parts of v.c. 16, 17 and 18, all of v.c. 21, and smaller parts of three other vice-counties. There are no records reported this year from v.c. 20, Herts. or v.c. 24, Bucks., and I mention v.c. 19, North Essex only to correct the one record mentioned last year (Burton 2000: 206); the reference to *Torilis nodosa* was a lapsus on my part, what was intended having been the much rarer spreading hedge-parsley *T. arvensis*. Within the section for each vice-county, my practice is to present first any records from inner London boroughs, then work outwards, finishing with parts of the London Area outside all the boroughs.

V.C. 16, West Kent

Margot Godfrey's records include corky-fruited water-dropwort *Oenanthe pimpinelloides* and grass vetchling *Lathyrus nissolia* from fields to be cut for hay at Woodlands Farm. The former used to be considered a very rare plant in London, but we now have seven localities for it in the Kent part of our area alone, though I have not been able to find it myself in the two others in Greenwich. In the same borough, I found a number of casual plants of hairy buttercup *Ranunculus sardous* in the grass of the car park at Eltham Palace. David Nicolle's records from his home Borough of Bexley include a plant of deadly nightshade *Atropa belladonna* in the shrub border by the main entrance to Queen Mary's Hospital, Sidcup; the association of this dangerous herb with old hospitals has been mentioned before, but Queen Mary's does not have that sort of history. John Palmer's long list included records from two Bexley localities, Hall Place and Crayford Marshes. Hall Place yielded unusual casuals on manure heaps near the River Cray: cockscomb *Celosia cristata*, *Crassula arborescens*, hoary stock *Matthiola incana*, a geranium *Pelargonium domesticum*, a tulip *Tulipa orphanidea* and *Verbena* × *hybrida*. Crayford Marshes was a valuable source of casual records thirty years ago when there was refuse tipping here and now produces established aliens, the odd casual alien still and incoming native species; the 2000 haul included bifid hemp-nettle *Galeopsis bifida*, a rarity in Kent, well established Montpellier broom *Genista monspeliensis*, very fine shining cranesbill *Geranium lucidum*, French mallow *Malva nicaeensis* and the first record from this part of our area of golden dock *Rumex maritimus* to be regarded as a native plant here. Mr Palmer also mentioned having seen marsh sow-thistle *Sonchus palustris* in its riverside locality nearby, the only one in London, the first report that it is still there for several years. Geoffrey Kitchener found the spreading alien narrow-leaved ragwort *Senecio inaequidens* in many places in Bexley, west as far as a point on the A2016 Eastern Way where he saw a single plant in the company of Mr Palmer, though it was more numerous, in hundreds, on the cleared site of Belvedere Power Station. Other reports of this species in Bexley came from Mrs Godfrey and from Sheila Mathieson. Further westward spread can be expected. The isolated occurrence of an individual of the same plant at Chelsfield Station reported by Mr Kitchener last year (Burton 2000: 202) has now grown to 42 plants along 25 metres. This is in Bromley; the other record from that borough to be mentioned is again of *Oenanthe pimpinelloides*; Mr Kitchener confirmed a scattering of it on the Ravensbourne Nature Trail at Keston, found by Ann Broad and Nadine Smith. Part of South Norwood Country Park is also historically in Kent, though now in the London Borough of Croydon; John Bedford reported that ragged Robin *Lychnis flos-cuculi* has spread from its original site near the lake here. It is most unusual for introductions of native species to be so successful.

An extension of range of *Senecio inaequidens* in the other direction, to the margin of our area in a Northfleet back street, is due to Richard Fitter. Again there are many distinguished records from the Kent part of our area contributed by Mr Palmer. Selected by me for a mention here are Chinese bramble *Rubus tricolor* by a track between Dartford and Barnes Cray and a bamboo *Pleioblastus variegatus* near a Dartford sporting facility, both perhaps originally planted but now wildly out of control; a similarly huge amount of musk storksbill *Erodium moschatum* in mown grassland south of Dartford, more likely introduced accidentally somehow; Balkan spurge *Euphorbia oblongata* on a wooded roadside bank near Shoreham, the first record from the Kent part of our area; and a roadside vernal-grass *Anthoxanthum* near Horton Kirby, with a tuberous stem-base, very wide ciliate leaves and long-awned spikelets, characters justifying his identification of it as *A. amarum* Brot., a calcifuge species from Portugal and north-west Spain not listed by Ryves et al. (1996) as having been previously recorded in Britain. Mr Kitchener's Kent observations included a careful count of the remaining populations of round-leaved wintergreen *Pyrola rotundifolia* near Swanscombe (a total of 1,894 inflorescences), as well as seven spikes of ivy broomrape *Orobanche hederae* and about six scattered plants of green-flowered helleborine *Epipactis phyllanthes*. Records of water-starwort species in our area are too few, so I was pleased to get John Edgington's of *Callitriche obtusangula* on Swanscombe Marshes. I consider two of my own Kent records only as being worthy of inclusion, Turkish iris *Iris orientalis* conspicuous on the slip-road from the M25 southbound to the M20 eastbound, on a bank where it can hardly have been planted, and a solitary monkeyflower *Mimulus guttatus* which had fallen out of a window-box and rooted itself at the foot of a wall at Eynsford station, where it flowered although only an inch high.

V.C. 17, Surrey

We have records from opposite ends of Southwark. In the north, where it is very much an Inner London borough, Nick Bertrand found hoary cinquefoil *Potentilla argentea* and the increasingly seen casual *Persicaria capitata*, communicated to me by John Archer. At the southern extremity of the borough in Sydenham Hill Wood, Elizabeth Norman, with Ken Page and Peter Coxhead, observed that the oaks are mostly the hybrid of the pedunculate and sessile oaks *Quercus* × *rosacea* and the few birches are mostly the hybrid of the silver and downy birches *Betula* × *aurata*; this is at variance with the plant list from this reserve dating from 1994, which gives no oaks except the two species and only the silver birch, probably as a result of inadequate observation, and with the findings of Lousley (1959), who used the occurrence of sessile oak as an indicator of ancient woodland remnants and noted only silver birch, as a colonizer of the derelict railway, but mentioned no hybrid trees — could the constitution of the wood have changed in forty years? Hairy vetchling *Lathyrus hirsutus* was observed on the 'Mounds' on Wimbledon Common at our Ornithological Section's meeting on 22 July; these are heaps of spoil from A3 roadworks in the Wandsworth part of the Common, where this unusual alien was known in the past but was thought lost since about 1989 (Mrs I. J. Kettle, pers. comm.). There was a better-known site for it in the 1980s on the western side of the Common in Merton, where it grew in the company of yellow vetch *Vicia lutea*. The latter was found in 2000 by Mr Bedford on soil levelled from the Tramlink construction near South Norwood Country Park. A plant of corn buttercup *Ranunculus arvensis* found by him in the Country Park, which had also had it a few years before, might just possibly have been from seed of the earlier occurrence and not a fresh sowing. In Richmond, George Hounsome sent me a specimen of a *Nigella* from a heap of soil on Barnes Common, where there had been more than fifty plants of it together; I could identify it as *N. sativa*, which is grown in Near and Middle Eastern countries for its black roasted seeds, which are used to decorate and flavour bread, often mixed with sesame or cumin. For a previous record from London and more information about this plant, see Wurzell (1990). Keith Bosher made the first record from Surrey or our area of *Rosa* × *rothschildii*, the hybrid of dog rose and Sherard's downy rose, expertly determined by Dr Primavesi, in Ham River Lands, where it had perhaps been misidentified before. On 13 August, I was privileged to be allowed to join the party organised by Plantlife to search for pillwort *Pilularia globulifera*, where it was last seen in London in 1962, in the ordinarily locked Pond Plantation. Even Nick Stewart in his waders was unable to find the plant, which has declined over much of its range due to eutrophication of the water and competition from invasive aliens, but by wading to an otherwise inaccessible bay he was able to bring back lesser marshwort *Apium inundatum*, cyperus sedge *Carex pseudocyperus*, bulbous rush *Juncus bulbosus*, lesser pondweed *Potamogeton pusillus*, lesser bulrush *Typha angustifolia* and horned pondweed *Zannichellia palustris*. Also in the Plantation were a single plant of small water-pepper *Persicaria minor* and naturalized musk *Mimulus moschatus*. Other aquatic plants found that day were hairlike pondweed *Potamogeton trichoides* dragged from the northern Pen Pond and a scrap of floating club-rush *Eleogiton fluitans* in the Leg of Mutton Pond.

Another unsuccessful Plantlife search, on 9 September, was for ground-pine *Ajuga chamaepitys* at the edge of our area east of Mickleham in Surrey. Some slight compensation was the discovery of minute plants of lesser centaury *Centaurium pulchellum* at the side of the track along Juniper Bottom. Mr Hounsome explored Brooklands and made the second record from our area of purple fescue *Vulpia ciliata* subsp. *ambigua*, by rabbit burrows; a few plants of southern marsh-orchid *Dactylorhiza praetermissa* were near the pond. Barry Phillips and Tom Cope found several rafts of floating water-pennywort *Hydrocotyle ranunculoides* by the Thames at Walton, a predictable extension of this extremely invasive plant. Peggy Dawe sent me a drawing of a *Scrophularia* from Chipstead which was quite adequate to determine the plant as water figwort *S. auriculata*, in spite of its yellow flowers. The plants found on Reigate Heath by the 10 June meeting of the Surrey Flora Committee included many musk stork's-bill *Erodium moschatum* and clustered clover *Trifolium glomeratum* on a bank across the road from the cricket pitch, where their status was uncertain, and a very large colony of *Scleranthus annuus* subsp. *polycarpos*. This segregate of annual knawel has not previously been reported from our area.

V.C. 18, South Essex

My mention last year (Burton 2000: 205) of Central Park, West Ham, in the Borough of Newham, was another error; Central Park, East Ham was intended. The other three boroughs in this part of London all produced excellent records in 2000. In Waltham Forest, there were two records of little robin *Geranium purpureum*, at sites about 1,500 metres apart. Although this is a new species for Essex and London, native in a few places along the south coast of England and more plentifully in southern Europe, it is difficult to know how it got to either site or what connects them. On the Essex Filter Beds it was first seen by Dave Miller. The more numerous plants on railway ballast near Coppermill Junction, which could only legally be seen from trains, were first spotted by Mr Hounsome. Other plants in this area of Walthamstow Marshes, reported to me by David Bevan, were penny-royal *Mentha pulegium*, slender thistle *Carduus tenuiflorus* and marsh dock *Rumex palustris*; it is likely that some or all of these were accidentally introduced as a contaminant of grass seed. Our records from Barking & Dagenham are from Jane Woodliff and the meeting on 9 September which she led at The Chase Nature Reserve. This is important for its wet habitats, which have marsh ragwort *Senecio aquaticus* in its only Essex station. Unfortunately there are problems here as in so many places with invasive aliens. The remaining plants of narrow-leaved water-plantain *Alisma lanceolatum* are threatened by mats of New Zealand pigmyweed *Crassula helmsii*, and an adjacent fishing lake suffers from floating pennywort *Hydrocotyle ranunculoides* which may have been successfully removed by the time you read this. Two splendid discoveries were made in Havering in 2000. At our meeting to Rainham Marshes on 1 July which he led, Mr Kitchener collected a dock which has every appearance of being the three-way cross between curled dock *Rumex crispus*, broad-leaved dock *R. obtusifolius* and Greek dock, *R. cristatus*, the first case of a triple hybrid dock found in Britain. At the Essex Field Club meeting at Dagnam Park on 16 July, the first Essex plants of slender spike-rush *Eleocharis uniglumis* were seen, as well as three fine stands of narrow-leaved everlasting-pea *Lathyrus sylvestris*, fine-leaved water-dropwort *Oenanthe aquatica* and orange foxtail *Alopecurus aequalis*.

V.C. 21, Middlesex

The only 2000 records to report here from the City of London and the inner London Boroughs of Tower Hamlets, Hackney and Islington are owed to Prof. John Edgington, continuing his researches into the distribution of wall ferns which he reported on in this journal (Edginton 2000). On foundation walls at the City church of St Mary Aldermanbury he found a substantial colony of maidenhair spleenwort *Asplenium trichomanes* subsp. *quadrivalens* and three plants of black spleenwort *A. adiantum-nigrum*. At the East India Dock there were about fifty mature plants of a polypody *Polypodium interjectum* on the dock wall, *Alisma lanceolatum* in the water, and on paved areas plants of lesser chickweed *Stellaria pallida* and medium-flowered winter-cress *Barbarea intermedia*; in the water of the canal at Mile End Lock was pedunculate water-starwort *Callitriche brutia*, which may not be a very rare species in London even though records of it are few. The same species was in the Lea Navigation by Hackney Marsh. More polypody was on brick graves in Bunhill Fields Cemetery and in a basement area in Sekforde Street EC1. In the City of Westminster Prof. Edgington found this fern by steps to an area in Balcombe St W1, where it was absent at the time of Hadden (1978). Mr Nicolle made the extraordinary discovery of a group of about fifty plants of Cape gooseberry *Physalis peruviana* on the flat pebble-covered roof of a four-storey building in Westminster — how on earth could they have got there? Aaron Woods found a large patch of *Hydrocotyle ranunculoides* in Regent's Park lake and a large plant of vervain *Verbena officinalis* by the canal barge moorings at St John's Wood. His notable records from Camden are of garden plants occurring casually on pavements: a 'busy Lizzie' *Impatiens walleriana* in Clarkson Row, in Arlington Road *Sanvitalia procumbens* (Compositae) not previously recorded from London, or indeed anywhere in Britain for about seventy years (Clement and Foster 1994), and in Albert Street the first British record of the North African composite *Coleostephus multicaulis*, occasionally grown under the name

Chrysanthemum multicaule and indeed not unlike a many-stemmed corn marigold. Pavements in another part of the same borough are the situation of Prof. Edgington's records of flixweed *Descurainia sophia* in Orde Hall Street and *Barbarea intermedia* in Bedford Square. In the garden of Mecklenburgh Square perfoliate alexanders *Smyrnium perfoliatum* was present as a weed, and common calamint *Clinopodium ascendens* was on the pavement fence outside the garden; he offered a clue how the former might have got there, telling me that the garden was once managed by the wife of David Duncan, director of the Chelsea Physic Garden, where the plant has long been a rampant weed. Black mulberry *Morus nigra* is described as being naturalized by the River Thames (Stace 1997:116) on the strength of a single bush growing out of the stonework of the river wall just east of Chiswick Bridge (Burton 1981: 92), where I cannot now find it. Never having seen any sign of germination among fallen mulberries, I was sceptical that this could happen, but Neil Anderson reports a seedling two feet high at the edge of Ravenscourt Park in the Borough of Hammersmith and Fulham; also there were many self-sown seedlings of foxglove-tree *Paulownia tomentosa* from a garden tree near this park.

In and around the millennium year 2000 many of the London boroughs started collating their own natural history records as part of their Biological Action Plans, creating potential new opportunities for collaboration. In the Borough of Haringey, this activity is managed by David Bevan, the Society's Conservation Officer, and our records from that borough this year are either his or have been communicated to me by him. I saw his photographs of hard fern *Blechnum spicant* in Queen's Wood, the one old crown of this rare London fern in the borough, and of shrubby scorpion-vetch *Coronilla valentina* subsp. *glauca* on Markfield Recreation Ground, South Tottenham, which sows itself freely, though the seedlings usually get taken away to be transplanted into private gardens. An even more unusual plant which Mr Bevan found growing wild in the borough, on waste ground off Tottenham Lane, was *Ballota pseudodictamnus*, a native of the eastern Mediterranean area. Dave Miller, already mentioned, was the finder of knotted bur-parsley *Torilis nodosa* on the North Marsh of Tottenham Marshes, and Barry Nicholson, surveying old railway sidings and adjacent British Gas land at Wood Green prior to development, discovered kidney vetch *Anthyllis vulneraria*, fern-grass *Catapodium rigidum*, greater knapweed *Centaurea scabiosa*, blue fleabane *Erigeron acer* and silver ragwort *Senecio cineraria*. Leslie Williams has a similar position to Mr Bevan's in the Borough of Brent; his succession of papers on Fryent Country Park in that borough might make one suppose that nothing new could be found there, but in 2000 one of the meadows which for once was without a contractor to mow it produced a patch of wood small-reed *Calamagrostis epigejos*, a rare grass in London.

In Hillingdon, the millennium was marked by the publication of *Wildlife 2000. A status report for Hillingdon*, including a chapter on the flowering plants by Ann Rix (2000). This does not give much scope for additions to the current flora of the borough, and there are only casual aliens to mention. In the rubbish dump west of Yiewsley which continued to be fruitful for Carol and Bill Hawkins, the more striking novelties were a patch of *Bergenia crassifolia* and plants of bladder ketmia *Hibiscus trionum* and flame nasturtium *Tropaeolum speciosum*. Against the wall of Bentley's pub in Yiewsley High Street Mr and Mrs Hawkins found a plant of garden pimpernel *Anagallis monelli*, another species new to the Society's records. Of similar status is the self-sown Mount Etna broom *Genista aetnensis* found in the Duke's Hollow car park in the Borough of Hounslow by Mr Hounsome. From this borough there are also two records of bee orchid *Ophrys apifera*: two strong plants by the canal path above Brentford, found by Diana Willment; and 46 spikes in a gravel working near Chertsey Road, found by Eleanor Lawrence.

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Obituary

XX(345034 1)

VICTOR FREDERICK HANCOCK, MBOU, 1915–2000

Vic Hancock, who died on 16 February 2000, was for many years one of those stalwarts who allow organizations such as the London Natural History Society to function. He joined the Society in 1954 and by 1957 had assumed the arduous role of Treasurer, an office which he held until 1964. During that time he worked tirelessly to balance the books of an impoverished society and led the successful campaign for us to achieve charity status. In 1965 he became our President; after his term of office he served on Council and for many years chaired the Administration and Finance Committee. He took on, with a cheery smile, many other duties including running a reading circle for the now defunct Geology and Archaeology Section until 1999. Vic was made an honorary vice-president in 1988 and until his death was available for consultation, always giving helpful advice.

Victor Frederick Hancock was born in Fulham in 1915; he won a scholarship to Sloane Grammar School and was tutored by Guy Boas, an eccentric headmaster who boasted that he taught boys to think and that was education enough (he had not changed when I followed Vic to Sloane twenty years later — AJB). In 1935 he joined the London Scottish Regiment — 1939 saw Vic on active service — later in the war he was with the Argylls in Italy. He had two careers, firstly rising to the rank of Pensions Superintendent with the Legal & General and then after his 'retirement' becoming a manager with Stephenson, Harwood (Solicitors).

Vic was a keen ornithologist, watching chiefly in Richmond Park, conveniently close to his home at Twickenham, combining this activity with cross-country running. Before the war he had joined Ranelagh Harriers and in 1948 he was one of the relay runners who had the privilege of carrying the Olympic Torch on its journey to Wembley. He served on the Committee of Bird Sanctuaries in the Royal Parks until this useful forum for research was dissolved in the late 1970s on the grounds of cost. His work as an ornithologist was recognized in 1994 when he was elected a life member of the British Ornithologists' Union.

A distinguished figure, short in stature, with strong features, ruddy complexion and above all his pipe, Vic always gave you a friendly welcome. He married Bee in middle life — those who knew him will recall his great delight when his only child, Zoë Victoria was born. To Bee and Zoë we send our condolences — to all others we say 'the London Natural History Society has lost a good friend and counsellor' — we shall miss him.

A. J. Barrett and R. H. Kettle

Book reviews

Atlas of the land and freshwater molluscs of Britain and Ireland. Michael Kerney. 1999. Harley Books in association with the Conchological Society of Great Britain and Ireland. 264 pp. £25. Hardback, ISBN 0 946589 48 8.

This is the long awaited update of Kerney's 1976 *Atlas of the non-marine molluscs of the British Isles*, published by The Conchological Society of Great Britain and Ireland and The Natural Environment Research Council. The Society has been a forerunner in biological recording since 1876 when W. Denison Roebuck began a systematic vice-comital census of British molluscs. In 1961 Michael Kerney, as newly appointed Non-Marine Recorder for the Conchological Society, started a scheme to record on a 10-km square grid, the first such to be used for an animal group (botanists had already converted to 10-km squares).

The book is a handsomely produced, B-format hardback, the deep green cover showing one of Derek Rands' excellent photos of *Zenobiella subrufescens* superimposed on a map. It sits comfortably in the hand, is clearly printed and easy to use. The opening chapters deal with the background, the CSGBI census scheme and factors affecting distribution. Kerney, not lacking in palaeontological expertise, details the history of the British fauna and also discusses implications for the future. The main section of the book provides maps, illustrations and species accounts. These are placed in systematic order which may be a little confusing to those unfamiliar with molluscs. At the end of the book are maps of environmental factors, lists of recorders and localities, a comprehensive bibliography and index.

The new *Atlas of the land and freshwater molluscs of Britain and Ireland* is a vast improvement on the original version. It is more sturdy; the binding makes it unlikely to be subject to spine damage from repeated use. The introductory chapters give a fairly detailed account of the records set into historical and biological context. These essays contain valuable insights into the relationships between man and molluscs as well as how Britain's molluscan fauna has developed and been recorded. In the *Collins Field Guide to the land snails of Britain and NW Europe* (M. P. Kerney and R. A. D. Cameron 1979) (the snail book with which LNHS members will probably be most familiar), a series of distribution maps is provided. These differ from those in either of the two *Atlases* in that some indication is provided as to whether the species is declining or increasing. It is interesting to compare all three books to see how accurate these estimates were. In some instances the number of localities for species has increased because of better recording techniques or a more fuller understanding of the habitat requirements of the species. Other cases, such as that of *Hygromia cinctella*, are a genuine and dramatic increase in distribution. There is no way to be aware of the causal effects of such changes by interpretation of the *Atlas* alone, and this can only be achieved by reading recent literature and following developments in the field. Kerney makes no attempt to define such changes, nor does he make any predictions as to the future status of any species. In his chapter 'The Future', he points out that 'distributions are not static' and that as an island with no endemic species of mollusc, the historical cut off point for conservation is in debate. He does not question that man's intervention is the most serious cause of decline (and success in some cases) of many species, but is hesitant in recommending an overall conservation strategy. Eventually he makes a somewhat ambiguous statement in which he suggests two general principles: 'the desirability of maintaining faunal variety. . . and secondly, a respect for habitats not merely as repositories . . . but as embodying a record of long-continued historical change, both natural and man-made'(p.20). After forty years working in the field, Kerney's understanding of molluscan relationships with their environment must be almost unsurpassed; it is a pity he is unable to provide a more definite view on the subject of conservation.

The maps, produced by the Biological Records Centre, ITE, Monks Wood, are very clearly printed with insets for the Channel, Shetland and Orkney Islands. The size of the maps means that this is unnecessary for Ireland as in the previous version. At the start of the map section there is a coverage map showing the number of species for the whole of the British Isles. To some degree this may be indicative of the amount of recording work carried out in various parts of the country, and Kerney points this out. The amount of coverage to produce this book, though not total, is quite impressive for forty years' work, although it may also indicate the distribution of conchologists! Kerney points out that the illustrations and descriptions are not intended to be produced as an identification guide, but nonetheless placing all three on the same page is very helpful. Synonyms and vernacular names are also given. The illustrations have been taken from a number of sources, some are recognizable from the *Collins Field Guide* and some are new. The quality of the line drawings subsequently varies quite considerably. Slugs are illustrated as whole animals, snails and bivalves are illustrated as shells only, which may not be helpful in all cases. No indication of colour is given. Although size is given in the descriptions, a bar scale would have been more helpful, especially in comparing related specimens. The habitat descriptions are consistently clear and well written in Kerney's precise style.

JANE REYNOLDS

The flora of roofs. R. M. Payne. 2000. 22 pp., paperback. A5. £3 post free. Available from the author at Applegate, Thieves Bridge Road, Watlington, King's Lynn, Norfolk PE33 0HL.

Ron Payne is an honorary vice-president of the Society and one of our longest-standing members. This little book follows his earlier (1998) account of *The flora of walls in west Norfolk* and is largely the result of an eight-year survey carried out in East Anglia while recording for the recently published *Flora of Norfolk* (Beckett, Bull and Stevenson 1999). Roofs (unlike walls) are rarely mentioned in local floras, so this publication is particularly welcome in breaking new ground and giving a fascinating insight into a widespread but generally rather hostile man-made habitat. Only vascular plants are covered in the study, leaving scope for a possible future account of the bryophytes and lichens (many of which are well adapted to such arid places). In my own part of north London, most of the roofs are steeply sloping and made of slate; they support no vegetation at all. Snapdragon *Antirrhinum majus* and buddleia *Buddleja davidii* occasionally grow up in the cracks of concrete chimney breasts, but genuine roof plants (for which the useful term 'tecticolous' has been coined) seem very scarce indeed in urban London. Ron Payne's survey of more rural roofs includes, by contrast, a total of no less than 168 species, although admittedly this figure is augmented by plants found growing in roof gutters (an important associated habitat which is fully covered in the text) and also those found on the tops of old war-time pillboxes.

The author has analysed the results of his extensive survey work (1,629 sites were examined) to draw a number of conclusions. As might be expected, the majority of plants were wind-dispersed so that the Asteraceae (Compositae) and the Poaceae (Gramineae) were particularly well represented. Stonecrops *Sedum* spp. are also, unsurprisingly for such a drought-resistant genus, found frequently, with biting stonecrop *S. acre* being the most widespread of all roof plants (occurring on 34 per cent of the roofs examined). I was more surprised to discover that rue-leaved saxifrage *Saxifraga tridactylites* was such a common roof plant, being particularly abundant in towns such as Ely (Cambridgeshire), Stamford (Lincolnshire) and Brandon (Suffolk). The most important factors governing the species richness of roofs turn out to be 1) neglect and 2) age (in that order of importance), which probably explains why there are so few roof plants in my rather salubrious and not particularly ancient part of north London!

The book concludes with short accounts of seven species having especially close associations with roofs. Pride of place is given to the house-leek *Sempervivum tectorum*, undoubtedly the roof plant *par excellence*, which is also appropriately illustrated on the front cover with a striking colour photograph. This is a well-researched little book which contains much useful information about a rarely studied habitat; it deserves to be widely read.

DAVID BEVAN

Ladybirds of Surrey. Roger D. Hawkins. Surrey Wildlife Trust, School Lane, Pirbright, Woking, Surrey GU24 0JN. 136 pp., over 96 illustrations. £12. ISBN 0 9526065 5 0.

This book continues the series of excellent Surrey invertebrate atlases but it is not simply a summary of distributions. It is based on twenty years of fieldwork which is reflected in the wealth of detail on ladybird feeding and reproduction. It starts with brief summaries of the nature of the survey, the topology of Vice-County 17, the naming and identification of ladybirds. A conventional identification key is not provided, instead a series of starting points (such as elytral pattern, habitat, size) is provided from which the reader can progress to the individual species accounts for confirmation. This is more than satisfactory for a small family such as the Coccinellidae and, in most cases, will be redundant because the superb colour plates suffice to identify most specimens. The illustrations include not only all mature ladybirds, including common pattern variants, but also many larvae as well as a few leaf beetles that might be mistaken for ladybirds. Pictures include even the 5-spot ladybird to enable identification of species away from Surrey. The book treats not only the ladybirds proper but also the smaller coccinellids commonly not recognized as ladybirds, although not all of these are pictured. At the time of writing, the list was up to date, even including the single specimen of the April Fool's ladybird *Rhyzobius lopanthae*, found in Morden Park during 1999.

The major part of the book is taken up by the accounts of individual species. These include not only tetrad distribution maps but lists of synonyms, rarity status (national and local), description of the species and its common variants, the early life stages (where known), habitat and so forth. They also contain many observations on feeding, phenology and other aspects of life history. These sections not only summarize present knowledge but add much to our scientific understanding.

There are excellent appendices which also act as indexes: ladybirds can be traced by their common or scientific names (including synonyms) as may prey animals and host plants.

The writing is lucid throughout, often amusing, and it is difficult to find fault. The only difficulty is in interpretation of the distributions. The preamble contains maps of the major towns, waterways and underlying geology of vc 17; the latter is delineated on the distributions, and, somewhat disconcertingly, the extent of urban areas is mapped on page 67 to compare with the urban distribution of the 2-spot. Since maps in this book and throughout the series are all to the same format, it would be useful if the publishers could provide transparent overlays to allow demarcation of, for instance, urban and wooded areas.

The book can be recommended to anyone whatever their level of interest in the Coccinellidae.

Paul Mabbott

The Aurelian legacy: British butterflies and their collectors. Michael A. Salmon, with additional material by Peter Marren and Basil Harley. Harley Books, Colchester. 2000. 275 × 210 mm., 432 pp., including 42 colour and 162 black & white illustrations. Hardback, ISBN 0 946589 40 2. £30.

Collecting has played the major role in the accumulation of knowledge and understanding of British butterflies, and to some extent still does so. It is something of a surprise, therefore, that nobody has until now provided us with such an encyclopaedic tome concerned with the collectors themselves. From Thomas Moffet (1553–1604) to John Heath (1922–1987), here are the biographies of 101 of some of the most notable collectors of butterflies in British history, occupying 144 pages of this large and attractive book. In most cases, these are illustrated by a photograph or other type of portrait of the man (or the woman) in question.

However, this work contains far more than just this. The opening chapter, entitled 'A short history of butterfly collecting in Britain', together with the subsequent chapter on 'Weapons of the chase', together occupying some 68 pages, provide a fascinating insight into a bygone era. Yet, there is more. Thirty-five butterfly species of particular historical interest are discussed in depth from discovery to present day; there is a chapter concerned with conservation and collecting in which the morality of butterfly collecting is discussed along with its effects, in a rational and unemotional manner. Appendix 1 lists the British and Irish butterflies together with their past and present common names whilst Appendix 2 is a chronological list of significant entomological events, such as the formation of entomological societies, the inception of entomological publications and other significant events. There are 42 pages of colour plates, several of which occupy full pages, and a further 162 containing black and white illustrations. These depict some of the superb paintings from the books by Moses Harris, F. W. Frohawk and others, as well as other topics, including the odd cartoon or two (I especially liked the 'great moment' at the annual dinner of the Entomological Society, on page 49 — but if you want to know what I mean you will have to buy the book !

This is fascinating reading. Both the authors and the publishers are to be congratulated for producing a work of historical reference that will surely prove invaluable for entomological researchers well into the future. It is well worth every single penny of the very reasonable cover price and I commend it to all who have yet to experience the delight of opening its pages.

Colin Plant

Dragonflies. Behaviour and ecology of Odonata. Philip S. Corbet. Harley Books, Colchester. 1999. 829pp. 252 text figures. 96 colour plates. £62.50 hardback, ISBN 0 946589 64 X.

At indoor meetings of the British Dragonfly Society, whenever some knotty problem came up, the speaker would turn to Professor Corbet: 'Philip, do you know?'. . . and of course, he did.

This is an amazing book — all 829 pages of it. I truly believe Corbet analysed and documented in one volume everything that was known about the behaviour and ecology of Odonata up to his chosen cut-off date of May 1997.

As dragonflies are 'honorary birds', they attract much more interest than do many other groups of invertebrates. In his preface, Corbet says that therefore they 'have an important role to perform in promoting awareness of the increasingly urgent need for conservation of freshwater habitats', and, indeed, he dedicates the book both to his family and to all those who directly or indirectly work to preserve the integrity of these habitats.

The design of the book follows the life cycle of the insects. It is in twelve sections: 1 introduction; 2 habitat and oviposition; 3 the egg and prolarva; 4 the larva: respiration and foraging; 5 the larva: biotic environment; 6 the larva: physical environment; 7 growth, metamorphosis and emergence; 8 the adult: general; 9 the adult: foraging; 10 spacial displacement by flight; 11 reproductive behaviour; 12 dragonflies and people. There are three splendid indexes: (i) an author index enabling you easily to find second and third authors and those whose names vary in different publications, (ii) an Odonata index, and (iii) a subject index. The Odonata index enables you to find all references to particular genera and species. For example, I looked up the most recent immigrant to London, *Erythromma viridulum* the small red-eyed damselfly. I found that it may emerge from a larva resting horizontally (on all sixes) on a lily pad (p.242); larger adults are more likely to disperse from the emergence site than small ones (p.418); it has a noted plant association with *Ceratophyllum*, which may determine habitat selection (p.591); and it was threatened in a fishless pond by the introduction of grass carp (p.669). The subject index led me effortlessly to an exposition of the parasites of both larvae and adult life stages — thus enabling me to answer a query from Don Freshwater.

The book may accurately be described as 'monumental'. It is logically organised, and is a wonderful resource for anything and everything you may wish to know about dragonflies — but it is not an easy read. The LNHS library has a copy, and I trust it is available for loan, as there is far too much in this weighty tome to be assimilated during a visit to South Kensington.

RUTH DAY

Wild Essex. A guide to the nature reserves and country parks of Essex and east London. Edited by Tony Gunton. 2000. 249 pp. Softback, ISBN 0 9530362 2 7, £12.75; hardback ISBN 0 9530362 3 5, £18.50. The Nature of Essex Series, No. 3.

The bumblebees of Essex. Ted Benton. 2000. 180 pp. Hardback, ISBN 0 9530362 4 3. £18.50. The Nature of Essex Series, No. 4.

Both available post-free from Lopinga Books, Tye Green House, Wimbish, Essex CB10 2XE.

Two excellently produced books from Dr David Corke which I commend to members of the Society.

Wild Essex includes all the nature reserves managed by Essex Wildlife Trust, London Wildlife Trust, The National Trust, the RSPB and the Woodland Trust in Essex and east London, as well as the country parks and wild places managed for wildlife and public access by local authorities and other organizations. It covers more than 30,000 acres over 170 sites. There are 130 detailed colour maps as well as numerous excellent colour photographs of many of the animals, plants and habitats, as well as charts to enable one to choose the best time to visit and to determine in advance the accessibility and facilities of each reserve.

Bumblebees of Essex is the first book on the bumblebees of any British county. It contains superb colour photographs of all the species of Essex and southern England and there is also a selection of insects that mimic bumblebees. Identification keys are provided to all the species of southern England — twenty of the twenty-five on the British list — as well as national and local status summaries and detailed Essex distribution maps, chapters on natural history, ecology, and the relation of bumblebees to humans. As with dragonflies and butterflies, the presence of bumblebees is a good indication of the health of habitats.

These two books are surely good examples of what can — and should — be produced to cover the other counties surrounding London.

K. H. HYATT

Book reviews index

The Millennium atlas of butterflies in Britain and Ireland. Jim Asher, Martin Warren, Richard Fox, Paul Harding, Gail Jeffcoate and Stephen Jeffcoate 20

Unto the hills. The history and wildlife of the South Downs. Patrick Coulcher 28

A guide to the identification of deciduous broad-leaved trees and shrubs in winter. Andrew May and Jonathan Panter 42

Guide to commoner water plants. Richard Orton and Anne and John Babbington . 42

A key to some common seaweeds. Text by Steve Morrell, illustrations by Carol Roberts 42

The rocky shore name trail: a key to common animals and plants on rocky shores. Clare Cremona, Andy Simms and Mark Ward 42

The birdwatcher's handbook: a guide to the birds of Britain and Ireland. Jonathan Elphick 108

Checklist of the flora and fauna of Wicken Fen. Compiled and edited by Laurie Friday and Basil Harley 126

Maggots, murder and men — memoirs and reflections of a forensic entomologist. Zakaria Erzinçlioğlu 126

The Apothecaries' Garden. A new history of the Chelsea Physic Garden. Sue Minter 134

International Code of Botanical Nomenclature (Saint Louis Code). Edited by a committee under W. Greuter (Chairman) and D. L. Hawksworth (Secretary) 134

The flora of the Bristol region. Wildlife of the Bristol region: 1. Ian P. Green, Rupert J. Higgins, Clare Kitchen and Mark A. R. Kitchen 158

The changing flora of Glasgow. Urban and rural plants through the centuries. J. H. Dickson, P. Macpherson and K. J. Watson 158

The ground beetles of Northern Ireland (Coleoptera-Carabidae). Roy Anderson, Damian McFerran and Alastair Cameron 158

The NEW reading the landscape. Fieldwork in landscape history. Richard Muir . . 166

Lichens. An illustrated guide to the British and Irish species. Frank S. Dobson . . . 202

Checklist of Lepidoptera recorded from the British Isles. Second edition (revised). J. D. Bradley 218

Log book of British Lepidoptera. J. D. Bradley 218

John Ray and his successors: the clergyman as biologist. Edited by Nigel Cooper . 218

Atlas of the land and freshwater molluscs of Britain and Ireland. Michael Kerney . 227

The flora of roofs. R. M. Payne 228

Ladybirds of Surrey. Roger D. Hawkins 228

The Aurelian legacy: British butterflies and their collectors. Michael A. Salmon, with additional material by Peter Marren and Basil Harley 229

Dragonflies. Behaviour and ecology of Odonata. Philip S. Corbet 230

Wild Essex. A guide to the nature reserves and country parks of Essex and east London. Edited by Tony Gunton 230

The bumblebees of Essex. Ted Benton 230

The London Naturalist

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Papers should be submitted **in duplicate** to the editor, Mr K. H. Hyatt at his home address, 1 Tremcelynog, Rhandirmwyn, Llandovery, Carmarthenshire SA20 0NU, before the end of January if they are to be considered for publication in the same year. However, the editor may be contacted at any time on 01550 760346 to discuss possible contributions, and will be pleased to send a recent offprint to show our style, and as a guide to preparing the manuscript. Manuscripts **must** be double spaced on one side of the paper only and with wide (3-cm) margins. Authors must retain a copy. Papers should include at the beginning an **abstract, summary** or **synopsis. Sheets must be numbered.** After acceptance, the editor would be pleased to receive contributions as ASCII files on disc in IBM-compatible format. Papers should be relevant to the natural history and archaeology of the London Area. This includes comparisons between London and its surrounding countryside with other localities, as well as work relating to or comparing species or habitats which occur in the London Area. Contributions of relevance nationally will also be considered.

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Locality spellings should follow the latest editions of the maps published by the Ordnance Survey. Capitalization should be kept to a minimum. Common names of animals and plants must begin with lower-case initials (except for proper nouns), and **only** Latin names of genera and species must be underlined unless typed in italic. When both common and Latin names are given there should be no brackets or commas separating them. **Genus names should appear in full where first used within each paragraph.** When scientific names are taken from a standard work, which must be cited, authorities should be omitted. In descriptive matter numbers up to 100 should be in words, except in a strictly numerical context. Dates should follow the logical sequence of day, month, year, i.e., 25 December 1971, but in lists may be as 25.xii.1971. Measurements should be in metric and follow the SI system (Système International d'Unités), with imperial equivalents in parentheses where appropriate. There should be no full point following Dr, Mr, Mrs, or St. Lists should be in systematic, alphabetic or numerical order. **Hyphens should not appear at the end of lines** as the right-hand margins of manuscripts do not need to be justified: **turn off the hyphenation option. Tables and figure legends should be typed on separate sheets at the end of the text. Word-processed text should not use italic, bold or compressed typeface. Paragraphs should be indented. Sentences must not begin with numerals.**

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Reference citation should be based on the Madison rules (*Bull. Torrey bot. Club* 22: 130–132 (1895)), except that a colon should always precede a page number. Capitalization in titles of books and papers in journals should be kept to a minimum. Journal titles should be in full, or follow the abbreviations in the *World list of scientific periodicals,* and be underlined or in italics. Book titles should also be underlined or in italics.

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MEADOWS, B. S. 1970. Observations on the return of fishes to a polluted tributary of the River Thames 1964–9. *Lond. Nat.* **49:** 76–81.

MELLANBY, K. 1970. *Pesticides and pollution.* Ed.2. Collins, London.

WHITE, K. G. 1959. Dimsdale Hall moat, part II. *Trans. a. Rep. N. Staffs. Fld Club* **92:** 39–45.

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No. 80

The London Naturalist

2001

Fritillaria meleagris in Middlesex . . . . *Frontispiece*

Officers for 2001 3

The Society's Recorders 4

Report of the Society for the year ending 30 June 2000 6

Official and sectional reports for 2000 12–14

FITTER, RICHARD — The wildlife of the London Area in 2100. Crocodiles or polar bears? 15–19

WILTSHIRE, ELINOR and COOMBES, ALLEN J. — *Quercus* × *turneri* Willd. — a rare London hybrid oak 21–27

KENT, DOUGLAS H. — The history of *Fritillaria meleagris* in Britain to 1900 29–41

BURTON, JOHN F. — A history of the vertebrate fauna of Blackheath and Greenwich Park, 1850–1999 43–98

MUIR, A. I. — Strandings of Royal Fish (Mammalia: Cetacea) in Greater London 99–107

REEVE, N. J., PALMER, I., JONES, K. E., BLANC, J. and FURE, A. — Trapping surveys of small mammals on Wimbledon Common, Bushy Park and Ham Lands, south-west London 109–125

WHEELER, ALWYNE — Restoring salmon *Salmo salar* to the River Thames; the work of the Thames Salmon Trust 127–130

DENNIS, M. K. — The birds of the Inner Thames — an avian highway 131–133

TITTLEY, IAN — Changes in the marine algal flora of the tidal Thames: a millennium review 135–146

MABBOTT, PAUL — Report of the second London ladybird survey, 1999–2000 147–157

SHAW, P. J. A. and BUCKHOREE, Z. — Collembola (springtails) of Brockham lime kilns, Box Hill 159–165

MILNER, J. EDWARD — Spider records for London and Middlesex counties in 2000 167–168

WILLIAMS, L. R. — London butterfly monitoring report for 2000 . . . 169–180

Survey of Bookham Common: fifty-ninth year
Progress report for 2000 181–192

BAXTER, ROGER and BAXTER, ELSPETH C. — Results of a five-year study of leaf miners (Diptera: Agromyzidae) on Bookham Common 193–201

Hampstead Heath Survey. Progress report for 2000 203–217

BURTON, RODNEY M. — Botanical records for 2000 219–224

Obituary: VICTOR FREDERICK HANCOCK, MBOU, 1915–2000 225–226

Book reviews index 231

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Supplement to
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The Society welcomes new members, both beginners and experts. Its recording area (the London Area) lies within a 20-mile (32-km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society comprises Sections whose meetings are open to all members without formality. For those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology, or rambling, there is a Section ready to help.

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The Membership Secretary, LNHS,
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THE LONDON NATURALIST

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THE NATURAL HISTORY OF BUCKINGHAM PALACE GARDEN, LONDON, PART 2

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The earthworms (Oligochaetae) of Buckingham Palace Garden

JOHN BATER
IACR-Rothamsted, Harpenden, Hertfordshire AL5 2JQ

Abstract

Six species of earthworms are reported from Buckingham Palace Garden from sampling carried out during June 1997. This compares with twelve species recorded in a survey during 1963. The two lists are compared.

Methodology

Bristowe (1964) recorded twelve species of earthworm at Buckingham Palace Garden. During June 1997, earthworms were sampled again, using the standard formalin extraction technique of Edwards & Lofty (1972). This involved diluting 25 ml of 40% formalin in 4.56 litres of water and applying this to 0.36m^2 of soil surface.

Pairs of quadrats were sampled at eight locations throughout the garden. These included areas under trees, in lawns and grass paths, in rough grassy areas, in flowerbeds, amongst *Rhododendron* and in mixed shrub beds. After application of the formalin solution, the quadrats were observed for 15–20 minutes. As worms appeared on the soil surface they were transferred quickly to glass honey jars containing 50% formaldehyde solution. This solution dispatched the worms quickly and preserved them for future identification using Gerard (1964).

Results

Table 1 shows the results of the survey carried out and compares the species recorded in 1997 with those of 1963. The numbers of individuals of each species are given as a percentage (to the nearest whole number where applicable) of the total number of earthworms observed.

Discussion

Eighteen species of earthworms have a wide European and British distribution. The six species of earthworms recorded from Buckingham Palace Garden are fairly typical of the species present in cultivated soil, parks and gardens throughout the British Isles. Although only sixteen quadrats were sampled in total, a surprisingly large number of individuals (298) was recorded, amounting to approximately eighteen individuals per quadrat. The 1963 survey recorded 400 clitellate worms. However, the sampling was done in September of that year, a month when earthworms would have been much more active than in June. Very few earthworms were found in the lawn surrounding the lake, the likely cause being the large amount of wildfowl droppings rich in ammonia, which is extremely detrimental to earthworms.

The most prolific areas were near the rose garden. Here, high numbers of *Lumbricus rubellus* were recorded. This species prefers habitats near large amounts of organic matter and, at the time of sampling, there was an ample covering of manure on the rose beds. *Eisenia foetida*, which was recorded in the 1963 survey, may have been inhabiting the manure on the rose beds, as it is a species which prefers to live in habitats with high concentrations of organic matter such as manure and compost heaps; unfortunately, however, it was not possible to sample within the beds themselves on this occasion.

Other species listed in the earlier survey but not recorded in 1997 include *Eophila icterica*, *Dendrobaena subrubicunda* and *Allolobophora nocturna*. *A. nocturna* is restricted to a few localities in the British Isles and a limited sampling is unlikely to record it. *E. icterica* and *D. subrubicunda* were recorded as single specimens and were almost certainly introduced in soil surrounding imported plants. *Octolasion cyaneum* was the only new species was recorded in 1997. Although not an abundant worm in the British Isles, it usually frequents moist wooded areas. The species was recorded in beds containing *Rhododendron* and other mixed shrubs, a very similar habitat to that on the Rothamsted Estate in Hertfordshire where it is observed frequently.

Comparing the 1997 survey with that of 1963, the population and species composition of the garden appears stable, probably as a result of the seasonal management of the grounds which seems to cause very little, if any, major disturbance. Of the species not found in 1997, an increased sampling in either spring or autumn would probably record most.

TABLE 1. Species of earthworms recorded in 1964 and 1997 as a percentages of the total number of earthworms sampled, (figures are adjusted to nearest whole number).

Species recorded	**Number of each species expressed as a percentage of the total earthworm numbers observed in the year indicated**	
Lumbricidae	**1963**	**1997**
Allolobophora caliginosa (Savigny,1826)	12	34
Allolobophora chlorotica (Savigny,1826)	7	3
Allolobophora longa Ude,1885	12	1
Allolobophora nocturna Evans,1946	1	0
Allolobophora rosea (Savigny,1826)	6	0
Dendrobaena rubida (Savigny,1826)	5	0
Dendrobaena subrubicunda (Eisen,1874)	0	0
Eisenia foetida (Savigny,1826)	1	0
Eophila icterica (Savigny,1826)	1	0
Lumbricus castaneus (Savigny,1826)	1	0
Lumbricus rubellus Hoffmeister,1845	21	27
Lumbricus terrestris Linneus,1758	33	34
Octolasion cyaneum (Savigny,1826)	0	1
Total numbers sampled	**400 (100%)**	**298 (100%)**

Acknowledgements

I wish to thank Mr Mark Lane, Head Gardener at Buckingham Palace, for arranging access to the Garden. My thanks also go to Andrew Coull, a member of the Palace gardening staff, whose enthusiasm for earthworm sampling and his extensive knowledge of the Garden made the time spent very rewarding. Finally, I would like to thank Mr Cliff Brooks, a colleague at IACR-Rothamsted, who transported me and my equipment safely to and from Buckingham Palace. IACR-Rothamsted receives grant-aided support from the Biotechnology and Biological Sciences Research Council of the UK.

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The tardigrade fauna of Buckingham Palace Garden

PHILIP M. GREAVES
4 Combe Common Cottages, Woodside Road, Chiddingfold, Surrey, GU8 4QR

Abstract

A total of 123 tardigrades of eleven species were extracted from plant material collected during a single visit to Buckingham Palace Garden in May 1996. One of the species found, *Isohypsibius sattleri* (Richters, 1902), represents a new record for the UK and a second species, *Diphascon (diphascon) bullatum* Murray, 1905, has previously only been recorded from Scotland. Although most of the species present are cosmopolitan in distribution, the diversity of tardigrade species is very high. These results are at variance with other studies of urban tardigrades, which have reported low species diversity.

Introduction

Tardigrades are microscopic, multicellular, invertebrate animals, commonly found in the surface water of mosses, lichens and in soils. Typically in the size range of 50 µm to 500 µm (although some individuals can reach 1.2mm), tardigrades possess four pairs of stumpy legs terminated in claws and have a characteristic 'bear-like' lumbering gait, which has lead to their popular name of 'water-bears'. Occupying their own phylum, Tardigrada, over eight hundred species have been described worldwide. Two aspects of tardigrades have attracted study for a number of years. Firstly, they possess characteristics of both annelids and arthropods and were considered for many years as a link between the two groups. Current taxonomic studies, however, have demonstrated that tardigrades are members of the arthropod clade. Secondly, terrestrial tardigrades have the ability to withstand prolonged periods of drought by a process known as anhydrobiosis. This state of suspended animation also confers extreme resistance to other environmental factors such as heat and radiation. Individuals have been recovered after many years in the anhydrobiotic state and this ability has probably allowed tardigrades (and other invertebrates) to colonise habitats that are exposed to repeated cycles of wetting and drying, such as mosses and lichens.

Despite their widespread occurrence, there have been relatively few systematic studies of the tardigrade fauna of the British Isles. The first published studies were by Murray (1911), who worked on Scottish tardigrades, principally from freshwater environments. Later studies have focused on the tardigrades of moss and lichen (e.g., LeGros 1957), whilst the first systematic study of the British tardigrade fauna, including marine species, was undertaken by Morgan (1976). More intensive studies of a limited locality have been undertaken by Greaves (1989), working on the tardigrade fauna of Surrey, and Greaves and Marley (1994), who surveyed the fauna of Bookham Common in Surrey as part of the ongoing London Natural History Society survey.

The tardigrade fauna of Buckingham Palace Garden was not investigated during the 1960–1963 survey and there have been no previously published records of tardigrades from Greater London.

Materials and Methods

Representative samples of mosses, lichens and decaying organic material were collected from Buckingham Palace Garden during a single visit in May 1996. The author was assisted in collecting by Mr Mark Lane, Head Gardener, who ensured that samples were collected from the range of environments present in the garden. Samples were hydrated in tap water on the same day that they were collected, and tardigrades collected 24 hours later by squeezing the water from each sample and sieving using a 45 µm sieve. Tardigrades were killed and fixed using Ripart and Petit's fixative and mounts for light microscopy, made with either André's mountant or Heinze polyvinyl alcohol and examined by phase contrast and differential interference contrast microscopy. Slides are held in the collection of P. M. Greaves (slide numbers T444 to T567).

An annotated list of Tardigrada recorded in Buckingham Palace Garden

HYPSIBIIDAE

Diphascon (diphascon) bullatum Murray, 1905

Although distributed widely, worldwide, this species has previously only been recorded in the UK from one locality in Scotland. It was found at Buckingham Palace Garden only in moss close to the waterfall at the lake.

Hypsibius dujardini (Doyére, 1840)

A truly cosmopolitan species that was frequently found in moss and lichen in the Garden.

Isohypsibius prosostomus Thulin, 1928

Another widespread species but, in the author's experience, is infrequently reported. In the Garden it was only found in moss growing at the rear of the summerhouse.

Isohypsibius sattleri (Richters, 1902)

This species is considered by some to be a synonym for *I. bakonyiensis* and hence there are mixed records for this species. However, both *I. sattleri* and *I. bakonyiensis* have cosmopolitan distribution, but have not previously been recorded from the UK. This is thus the first record for this country. The species was found in moss at three locations in the Garden.

Isohypsibius schaudinni (Richters, 1904)

Found only at one location, in moss growing on artificial rock.

Ramazzottius oberhaeuseri (Doyére, 1840)

Another cosmopolitan species, which is frequently encountered. It was only found in the Garden in lichen growing on a sandstone bridge.

MACROBIOTIDAE

Macrobiotus echinogenitus Richters, 1903

A common species, which was found in moss at two locations.

Macrobiotus cf. harmsworthi Murray, 1907

This widespread species complex cannot be identified to species level without the presence of eggs, which were not found during collecting. It was encountered in moss in the rock garden.

Macrobiotus cf. hufelandi Biserov, 1991

Another complex that cannot be resolved to species level in the absence of eggs. It is, perhaps, the most frequently encountered tardigrade in collections from moss, but was present in only two samples of moss and one of lichen taken from the Garden.

MILNESIIDAE

Milnesium tardigradum (Doyére, 1840)

This cosmopolitan, carnivorous species was found in lichens, but not moss, in the Garden.

ECHINISCIDAE

Echiniscus testudo (Doyére, 1840)

Two varieties, var. *trifilis* and var. *quadrifilis* (varying in the number of body appendages) were found in a single sample of moss taken from a roof in the Stone Yard.

Discussion

Of the thirty-eight samples taken, sixteen yielded a total of 123 tardigrades. Eleven species were present from seven genera. *Hypsibius dujardini* was the most frequently encountered species, present in eight of the sixteen samples that yielded tardigrades. *Macrobiotus cf. hufelandi* and *cf. echinogenitus* were also frequently encountered. Both Heterotardigrades and *Diphscon* species were rare, with only one species of each present in one sample. Two of the species found represent new records for England; *Diphascon bullatum* has previously only been recorded from Scotland and *Isohypsibius sattleri* has not been recorded from the UK before (McInnes 1994).

There have been relatively few published studies of tardigrades in urban environments (Kinchin 1994). Those studies that have been conducted have generally found few species. Meininger et al (1985), for example, found only four species of tardigrade in urban locations in Cincinnati, Ohio, compared to eight species in neighbouring rural areas. Several reasons for the low species diversity in cities have been postulated, including the 'heat sink' effect of cities, increased convection turbulence, decreased relative humidity, air quality and light penetration. Analysis by Meininger et al (1985) demonstrated high correlation between species diversity with increasing relative humidity and decreasing sulphur dioxide levels.

The results obtained at Buckingham Palace are at variance with other published data. Considering the size of the locality (16 hectares), the tardigrade fauna is highly diversified. By comparison, the county of Surrey, immediately to the south of Greater London, comprises 167,000 hectares and has produced 19 species during an eight-year sampling period (Greaves, 1989; Greaves and Marley, 1994).

Why the diversity of tardigrade species at this site? There has been a dramatic reduction in sulphur dioxide levels in London from a high of 2,830 $\mu g / m^3$ in 1952 to a reported range of 0 – 75 $\mu g / m^3$ in 1996 (Hawksworth 1999), but the current range is comparable to that of the Ohio study. Two factors are postulated as being important at Buckingham Palace Garden. Firstly, the use of organic mulches may increase local humidity levels such that the rate of drying is slower, allowing tardigrades to encyst; approximately 300 cubic metres of organic matter are applied to the Garden per annum. Secondly, the importation of plants and organic material into the gardens from other locations will lead to the importation of tardigrades at a higher rate than would occur naturally. Thus the rate at which species invade may be a key factor in determining which species ultimately prosper in the urban environment. Do urban environments operate according to the principles of island biogeography (MacArthur and Wilson 1967) for tardigrades? Undoubtedly, more work remains to be undertaken in this field.

Acknowledgements

Thanks are due to Mr Mark Lane for his assistance during collecting at the Garden and to Professor Roberto Bertolani of the University of Modena, Italy, for his help in confirming some of the species identifications.

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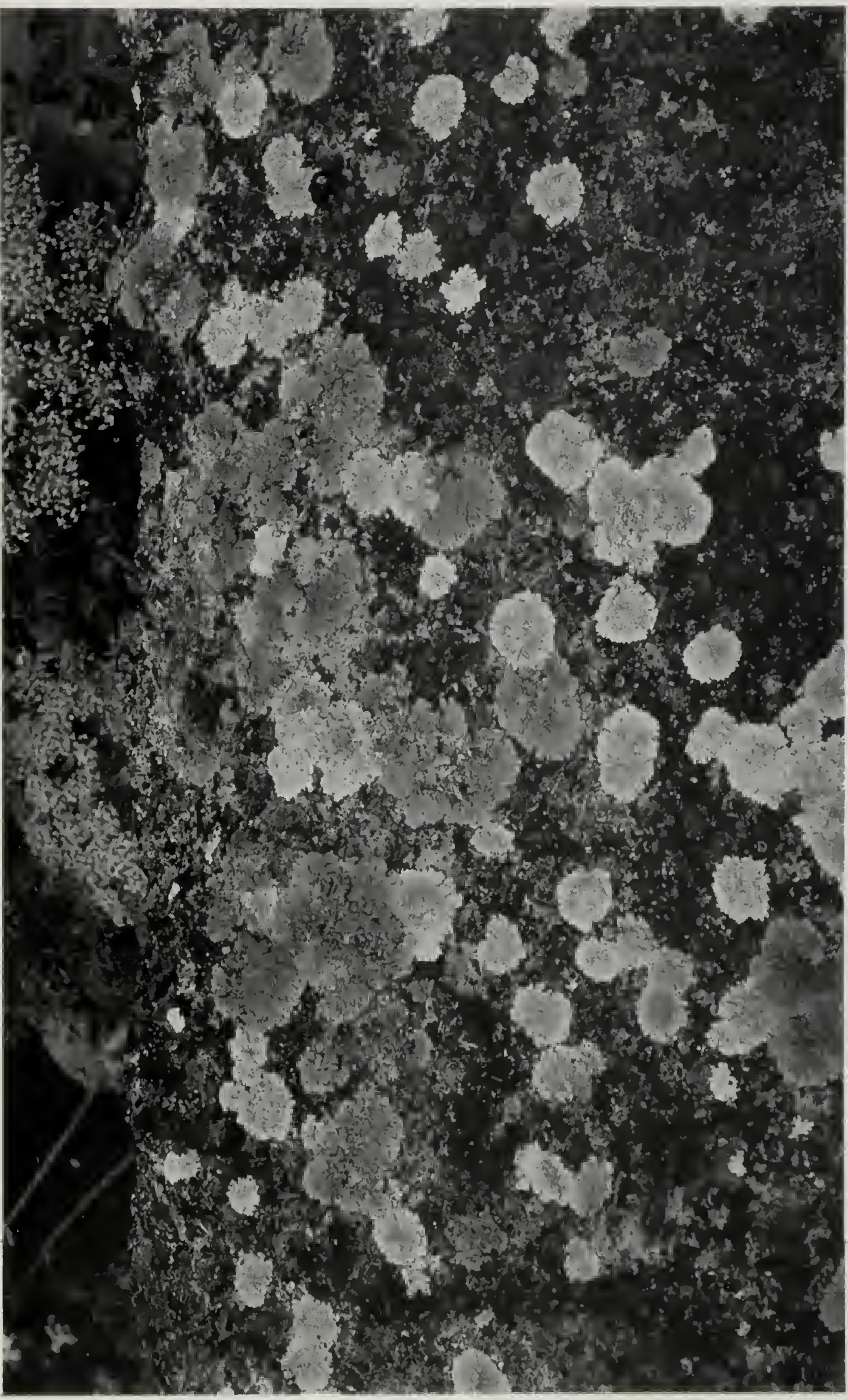

PLATE F. Buckingham Palace Garden, London. Lichens growing on a bridge parapet — a typical tardigrade habitat. *Photographed © by Mark Lane*

Rotifera and Anomopodan Crustacea in Buckingham Palace Garden Lake

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Abstract

Seventeen taxa of Rotifera and twelve of anomopodan Crustacea were recorded from Buckingham Palace Garden Lake during the course of four visits from 1996 to 1998. The lists are compared with those obtained during a survey carried out in 1963 in which sixteen taxa of Rotifera and eighteen of anomopodan Crustacea were reported. Amongst the rotifers, ten previously recorded taxa were not refound during the present study and nine taxa not previously recorded were collected; twenty-five taxa of Rotifera are now known from this water body. Of the anomopodan Crustacea, nine of the previously reported taxa were not refound and three previously unrecorded taxa were noted. A total of twenty-one anomopodan Crustacea are therefore listed from the lake.

Survey methods

Samples were collected from the bank at six widely-spaced sample stations. The positions of these stations are indicated in Figure 1 and each is briefly described in Table 1.

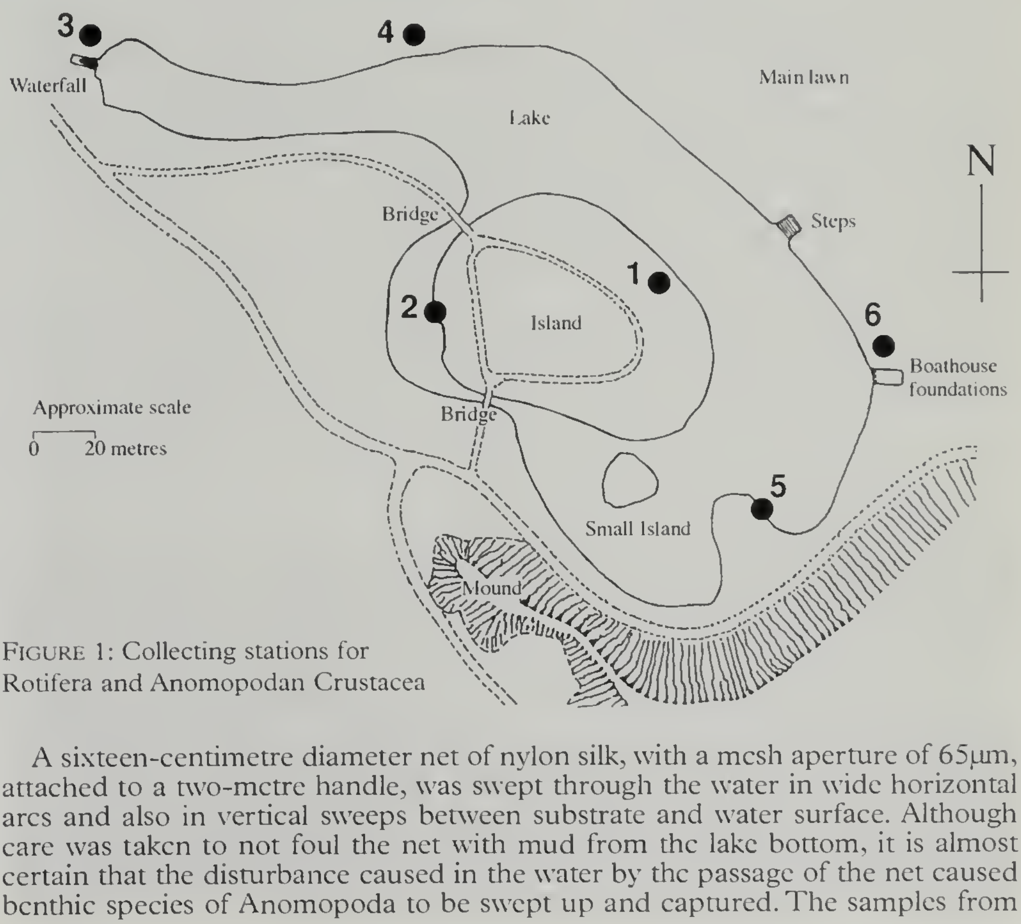

FIGURE 1: Collecting stations for Rotifera and Anomopodan Crustacea

A sixteen-centimetre diameter net of nylon silk, with a mesh aperture of 65μm, attached to a two-metre handle, was swept through the water in wide horizontal arcs and also in vertical sweeps between substrate and water surface. Although care was taken to not foul the net with mud from the lake bottom, it is almost certain that the disturbance caused in the water by the passage of the net caused benthic species of Anomopoda to be swept up and captured. The samples from each station were placed in separate containers without any preservative to permit live examination, so avoiding difficulties resulting from the distortion of specimens. Specimens were held still in a Martin Gravity Compressor (Hollowday 1985), or under a cover-glass supported on petroleum jelly, and examined at magnifications between x30 (for initial searching) and x800 (for identification). For the specific determination of the rotifer *Polyarthra dolichoptera*, the trophi were dissolved out with sodium hypochlorite and examined with oil-immersion at a magnification of x1000. Following initial examination, samples were preserved in 2 percent formalin (Amoros 1984) for further examination at a later date.

Temperatures during each sample period were recorded at a position ten centimetres below the water surface and pH values were also obtained, using a BDH Lovibond colorimetric comparator during 1996, but with a pH meter during the following two years.

TABLE 1. Location and description of Rotifer and Anomopoda sampling stations

Sample station number	Location	Comment
1	Adjacent to Island	Man-made habitat. The bank comprises rocks held in wire-netting. Samples taken amongst rushes.
2	Flamingo Shed	Shaded by trees. The water is fairly stagnant and there are large accumulations of detritus.
3	Waterfall	A small, two-level waterfall circulating the lake water via a pump. Detritus accumulates in the middle area.
4	Opposite intake pump	Near to trees. The wind blows detritus into this area.
5	Table	Calm water, surrounded by trees.
6	Boathouse	Exposed area by a small jetty.

Rotifera

Rotifer taxonomy

For brevity and simplicity, when comparing the total number of taxa in this and an earlier survey by Evans et al (1964), each taxon is referred to as a 'species', even though in the earlier work three taxa are designated 'varieties'. Two of these, which were not refound during the present study, should now be designated as subspecies according to the *International Code of Zoological Nomenclature* (1985: Article 45g). The third 'variety' in the previous report, *Keratella cochlearis* var. *tecta,* appears in the present list where it is treated as a possible morphotype resulting from cyclomorphosis, and is termed f. *tecta*, a practice adopted in the literature for many years. According to Nogrady et al (1993), however, there is now a tendency to treat it as a valid species and for convenience I have included it as a separate entry in the list. Similar remarks apply to *Brachionus quadridentatus cluniorbicularis*, for many years termed a variety, but here listed as a subspecies in accordance with Article 45g of *The Code*.

TABLE 2.
Rotifera and anomopodan Crustacea in Buckingham Palace Garden Lake, 1996 to 1998. Distribution of species by date and sample station

Date of sample →	22.vii.1996						2.xii.1996						10.iii.1997						1.vi.1998					
Sample station number →	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Species recorded ↓																								
ROTIFERA																								
Asplanchna priodonta							●	●											●	●		●	●	
Brachionus angularis			●			●	●	●			●	●	●	●			●							
Brachionus calyciflorus							●	●					●											
Brachionus quadridentatus ssp. cluniorbicularis			●																					
Brachionus urceolaris	●						●						●				●	●						
Cephalodella auriculata	●																							
Keratella cochlearis	●	●		●		●	●	●	●		●		●	●	●	●	●	●	●	●		●	●	●
Keratella cochlearis f. tecta	●	●				●													●	●		●		●
Keratella quadrata	●	●		●	●		●	●	●		●	●	●	●	●	●								
Lecane closterocerca	●						●																	
Polyarthra dolichoptera		●	●		●		●	●	●				●		●	●			●		●	●		●
Pompholyx sulcata	●																			●		●		
Synchaeta pectinata							●	●	●				●											
Testudinella elliptica				●																				
Trichocerca tenuior														●										
unidentified bdelloids				●							●													
ANOMOPODA																								
Daphnia ambigua	●		●									●							●	●	●			●
Daphnia hyalina	●		●								●									●	●	●	●	●
Simocephalus vetulus																						●	●	
Ceriodaphnia dubia			●								●										●			
Bosmina longirostris	●	●	●				●	●				●	●			●	●		●	●	●	●		●
Chydorus sphaericus											●	●							●	●			●	
Alona affinis							●														●			
Alona guttata																●								
Alona quadrangularis															●									
Pleuroxus aduncus												●												
Pleuroxus denticulatus	●																							
Pleuroxus uncinatus												●												

Results and discussion

A complete list of the Rotifera recorded in The Lake is presented below. This list is analysed by date and sample station in Table 2.

As was the case during an earlier study, the present survey was limited, being necessarily confined to four separate visits extended over a three-year period.

In order to obtain a reasonably comprehensive picture of the rotifer fauna of any water body, large or small, it is necessary to sample the habitat at least once each month over a period of several years. The rotifer population is constantly changing, from week to week, in a given aquatic habitat — particularly in the plankton zone. This is not because species are extinguished from the habitat, but more as a result of them passing into a resting phase. These resting phases may last several months or a number of years, during which they are absent from the active component of the fauna and rest on the bottom or in various niches as 'resting' (mictic) eggs. A species may occur in many thousands per litre for a few weeks, only to disappear in less than a week to be replaced immediately by another.

It is almost certain, therefore, that the lists compiled during both of the surveys at Buckingham Palace Garden Lake would have trebled, at least, if sampling had been practical at a greater frequency. However, there is also no doubt that the lists are short for another reason — the apparent absence of submerged macrophytes, noted by the present author and commented upon in an earlier work by Kett and Kirk (1999). Almost all aquatic habitats support at least some submerged plants, and these in turn provide a rich source of weed-haunting rotifers; the almost complete lack of these species from the list is clearly a direct consequence of this lack of waterweed. It is also likely that a more intensive sampling of sediments on the bed of the lake would have generated a longer list of benthic species.

The species encountered during both surveys are typical of the fauna associated with British lowland hard-water eutrophic habitat. The pH values at the sample stations varied from 8.0 to 8.8 during the present survey, except that the value at Station 5 on 1st June 1998 was lower, at 7.5. The range reported in the earlier survey was 7.8 to 8.4. These values all accord closely with those supplied to the Palace by Central Scientific Laboratories of London, Public Analysts, in 1991, 1992 and 1994, during which period they ranged from 7.3 to 8.5.

Many rotifers are tolerant of a range of pH values, whilst others are acidophilic and some occur only in alkaline habitats (Bērziņš and Pejler 1987). Apart from two unidentified bdelloids and *Testudinella elliptica*, whose requirements are not known, and *Brachionus calyciflorus*, which appears to be confined to alkaline waters, all the species in the present list are acid-tolerant, though all are at maximum abundance in alkaline conditions. This also applies to those species recorded in the earlier survey, again with the exception of *B. calyciflorus*, data not being available for the two named species of bdelloids it contained.

Much the same applies to the thermal range of Buckingham Palace rotifers. In the present list only one species, *Pompholyx sulcata*, may be termed a warm stenotherm. It is a well-know "summer" species with a maximum abundance between 12° and 23°C, although Bērziņš and Pejler (1989) quote a range of 6° to 25°C for its total thermal tolerance in Sweden. In Buckingham Palace Garden Lake, it occurred in large number at 19°C (July 1996) and 17°C (June 1998). The remaining species have a sufficiently wide thermal range to warrant being regarded as eurytherms. The same remarks may be applied to the earlier list, apart from *Notholca acuminata* and *N. squamula* (not refound in the current survey), which are regarded as cold stenotherms.

Eleven species in the present list are planktonic in lakes of all sizes, although with the exception of *Pompholyx sulcata* they will sometimes occur in quite small ponds provided that the water is clear of submerged macrophytes. The remaining six, including the two unidentified bdelloids, are littoral and benthic in habit, *Testudinella elliptica* being a commensal on the isopod crustacean *Asellus* (as was one of the bdelloids).

Additional notes on individual species of rotifers

Of special interest was the presence of *Brachionus quadridentatus cluniorbicularis*, a single specimen being found at Station 3 on 22 July 1996. Originally described from the Volga in 1894, it is also known from Europe and was more recently found on Hainan Island off the south coast of China (Koste and Zhuge 1996). There is only one previous British record of this species (Hussey 1985), where it is listed on the basis of a permanent mounted slide in the collection ofThe natural History Museum. The specimen was collected and mounted by the late E. W. Carlier from Mullard's Pond, Bentley Heath, Warwickshire in 1943.

B. quadridentatus cluniorbicularis is a typical weed-haunting rotifer, a good swimmer but not a true planktont, usually found in small ponds where, like *B. urceolaris*, it tends to attach itself to submerged macrophytes and algae by mucous secretions of the foot glands. It is highly variable in respect of the rear spines of the lorica and some six 'varieties' have been named over the years (Koste 1978), including *cluniorbicularis*. It is possible that they are all morphotypes, but *cluniorbicularis* is considered here as a provisional subspecies.

Testudinella elliptica is one of several commensal rotifers which habitually attach themselves to the aquatic isopod *Asellus* in the vicinity of the pleopods, in which situation it was found in Buckingham Palace Garden Lake. It is rarely found away from the crustacean, although the strong coronal cilia, usually used for current feeding, enable it to swim strongly when detached.

A number of contracted bdelloid rotifers were found during a re-examination of the formalin-preserved samples taken at Station 5 on 2nd December 1996. Although their contracted state did not permit identification, they appeared all to be of the same species, and their comparatively short spurs precluded them from belonging to either of the two species listed in the earlier survey (*Rotaria magna-calcarata* and *R. neptunia*). A single, live bdelloid was dislodged from the *Asellus* upon which *Testudinella elliptica* was found, but this, too, contracted and eluded identification. Its rather short spurs disallowed it being identified with either of the two aforementioned species from the first survey. Interestingly, Donner (1965) mentions the occurrence of *R. magna-calcarata* on *Asellus*, but the earlier report does not mention it being thus found.

Anomopodan Crustacea

Anomopodan taxonomy

The 'waterfleas' were listed in the report of the 1963 survey (Evans et al 1964) under the long-established heading of Cladocera. As pointed out by Fryer (1987a), however, more recent research has shown that the organisms collectively so designated "comprise a heterogeneous assemblage of forms that have no close phyletic affinities". It was, therefore, proposed that the former taxon of Cladocera be split into four Orders — Anomopoda, Ctenopoda, Onychopoda and Haplopoda (Fryer 1987b).

Evans et al (1964) noted that the taxon *Alonella rostrata* (Koch), which was not refound in the present survey, had been place in the genus *Rhynchotalona* prior to 1959, but that Frey (1959) had shown that it belonged in *Alonella*. Subsequently, however, Fryer (1968) has shown that it is generically distinct and should be known as *Disparalona rostrata* (Koch), under which revised combination it is now included in the present report. *Chydorus globosus* Baird, also not refound in the present survey, has also been shown to differ markedly from its supposed congeners, the apparent resemblance being due to convergence (Fryer 1968), and is now listed as *Pseudochydorus globosus* (Baird).

It is usually stated that the sensory seta between the eye and the base of the rostrum in *Bosmina longirostris* is situated halfway between these points. The Palace lake specimens had this seta slightly nearer to the rostrum, a typical example showing it 82μm from the eye and 56μm from the base of the rostrum.

This is a characteristic long-associated with the taxon formerly known as *B. coregoni* Baird, recently shown to be *B. longispina* Leydig (Fryer 1993). The fine setae at the base of, and along the length of, the claw, plus the fact that *B. longispina* is almost entirely confined to acid habitats, leaves no doubt as to the identify of the Palace lake specimens and it would seem that the exact position of the sensory seta between eye and rostrum may be a variable feature.

Frey (1993) proposed the division of the genus *Pleuroxus* in to four subgenera, namely *Picripleuroxus*, *Tylopleuroxus*, *Peracantha* and *Pleuroxus* sensu stricto. Under this scheme, of the three Palace lake taxa *denticulatus* would be allocated to *Picripleuroxus*, *aduncus* to *Tylopleuroxus* and *uncinatus* to *Pleuroxus* sensu stricto. Smirnov (1996) rejects this arrangement, but retains *Picripleuroxus* elevated to generic level and containing *denticulatus*. In the present work, I have followed Smirnov in retaining *aduncus* and *uncinatus* within *Pleuroxus*, but have also retained *denticulatus* in that genus.

Results and discussion

A complete list of the anomopodan Crustacea recorded in The Lake is presented below. This list is analysed by date and sample station in Table 2.

The anomopodan fauna of the lake at Buckingham palace Garden is typical of British lowland, eutrophic habitat, although at least two taxa, *Daphnia hyalina* and *Alona quadrangularis*, are known from upland oligotrophic locations, and at least eight will tolerate varying degrees of acidity. The lack of submerged macrophytes may not influence the benthic and littoral component of the anomopodan fauna to the extent that it affects the Rotifera, largely due to the fact that approximately twelve taxa tend to be bottom-dwellers, thriving in mud and a variety of similar substrates.

Four of the recorded taxa are planktonic (*Daphnia hyalina*, *D. ambigua*, *Ceriodaphnia dubia* and *Bosmina longirostris*).

Daphnia magna, not refound in the present survey, while occurring in open, weed-free waters, tends to favour very shallow farmyard ponds with a very high organic nutrient content and is not normally a component of the plankton of deeper lakes.

Of special interest is the occurrence in the lake of *Daphnia ambigua*, considered to be a North American "import". It was first described by Scourfield (1946) from Kew Gardens, where it had first been noted in 1939. Subsequent to this, it was recognised in North America and Western Europe where Amoros (1984) reports its occurrence as sporadic. Following the Kew record it was found in Regent's Park Lake (Fox 1948). In 1960 it was abundant in The Serpentine in Hyde Park (Evans *et al* 1964), and was first noted in Buckingham Palace Garden Lake in the same year whilst in 1962 it was found in The Long Water at Hampton Court (Evans et al 1964). The latter authors pointed out that, until 1961, the water in the Palace lake was supplied from an artesian well in Duck Island in St James' park via The Serpentine, and opine that *D. ambigua* may have reached the Palace lake via this route.

Daphnia ambigua was found on three of the four visits by the present author, being numerous at stations 1 and 3 on 22nd July 1996, but with only a few specimens found (at station 6) on 2nd December that year. It was completely absent in March 1997 but again numerous at stations 1, 2, 3 and 6 on 1st June 1998. It would appear to lay fertilised (ephippial) eggs in the late autumn/early winter period, reappearing in Spring or early summer. However, Scourfield (1946) reared it in captivity for several months and kept at least one specimen alive from 6th January to 22nd May, during which time, it passed through no less than twenty-four stages. A feature of the development is the gradual reduction in the length of the shell spine, which may be one third as long as the main carapace length in neonates to a mere 'bump' in fully grown adults. Most of the specimens found on 22nd July 1996 were adults almost devoid of a spine, although younger stages with a longer spine were present. It was noticed, however, that at least one specimen, having a spine corresponding to Scourfield's fourth stage, was slightly larger than specimens with a bump corresponding to his twelfth stage and, thus, it would appear that, possibly as a result of varying nutritional levels, later stages may not always be larger than younger ones.

The three new additions to the anomopodan fauna of Buckingham Palace Lake are of ecological interest.

Alona guttata, which occurred at station 4 on 10th March 1997, has a very wide pH tolerance, ranging from 3.3 to 8.55 (Fryer 1993), and is regarded as being a common and widely distributed eurytrophic species in the British Isles.

Alona quadrangularis in company with the closely associated A. affinis (found in both surveys), also exhibits a wide pH range tolerance, between 4·8 and 8·6 (Fryer 1993). Both species tend to favour alkaline, eutrophic, lowland sites and yet, occasionally, occur in acid, oligotrophic uplands. *Alona quadrangularis* was found at station 3 on 10th March 1997.

Pleuroxus denticulatus is rather a rarity in the British Isles and its occurrence in the Palace Lake at station 1 on 22nd July 1996 appears to be only the third for Britain. Originally known only from North America, it was first found in Britain by Scourfield (1907) in a small pond at Exminster, Devon. It was found more recently by Green (1966) at Hampton Court. The three Buckingham palace specimens accord exactly with Scourfield's detailed description and figures. In North America it is reported as common in weedy ponds (Brook 1959) and Amoros (1984) notes that it is found in the periphyton of ponds and lakes. Fryer (personal communication) has not found it in his exhaustive collecting over a period of almost fifty years in Yorkshire and it is probably still confined to eutrophic habitats in the south of England. Although apparently preferring 'weedy' habitat, the station at which it was found in the Palace Lake had a quantity of grasses hanging down into the shallow water and this possibly afforded it the conditions that it prefers.

A list of the Rotifera and Anomopoda recorded in The Lake at Buckingham Palace Garden

The classifications adopted in the list are those found in all modern works, except that Rotifera is elevated to Phylum status, rather than being retained as a Class within Aschelminthes, in accordance with Nogrady et al (1993). Notes on generic and specific nomenclature are given above. Species recorded in both the current and the earlier survey are indicated with an asterisk (*). Species recorded in the earlier survey, but not refound during the present work, are enclosed in parentheses. Species lacking an annotation are found for the first time in the present survey.

ROTIFERA
DIGONONTA
BDELLOIDEA
PHILODINIDAE

(*Rotaria magna-calcarata* (Parsons, 1892))
(*R. neptunia* (Ehrenberg, 1832))

Note: Two additional species of bdelloid were found in the present survey but were unidentifiable due to contraction in the preservative.

MONOGONONTA
COLLOTHECACEA
COLLOTHECIDAE

(*Collotheca ornata cornuta* (Dobie, 1849))

FLOSCULARIACEA

FLOSCULARIIDAE

(*Ptygura crystallina* (Ehrenberg, 1834))

TESTUDINELLIDAE

Testudinella elliptica (Erenberg, 1834)
(*T. patina* (Hermann, 1783))
Pompholyx sulcata Hudson, 1885

PLOIMIDA

ASPLANCHNIDAE

* *Asplanchna priodonta* Gosse, 1850

BRACHIONIDAE

* *Brachionus angularis* Gosse, 1851
* *B. calyciflorus* Pallas, 1766
(*B. leydigii tridentatus* Zernov, 1901)
B. quadridentatus cluniorbicularis Skorikov, 1894
B. urceolaris O. F. Müller, 1773
Keratella cochlearis (Gosse, 1851)
**K. cochlearis* f. *tecta* (Gosse, 1851)
* *K. quadrata* (O. F. Müller, 1786)
(*Notholca acuminata* (Ehrenberg, 1832))
(*N. squamula* (O. F. Müller, 1786))

COLURELLIDAE

(*Colurella uncinata* (O. F. Müller, 1773))

LECANIDAE

Lecane closterocerca (Schmarda, 1859)

NOTOMMATIDAE

Cephalodella auriculata (O. F. Müller, 1773)

PROALIDAE

(*Proales daphnicola* Thompson, 1892)

SYNCHAETIDAE

Synchaeta pectinata Ehrenberg, 1832
* *Polyarthra dolichoptera* Idelson, 1925

TRICHOCERCIDAE

Trichocerca tenuior (Gosse, 1886)

CRUSTACEA
BRANCHIOPODA
ANOMOPODA

DAPHNIDAE

**Daphnia ambigua* Scourfield, 1946
**Daphnia hyalina* Leydig, 1860
(*Daphnia magna* Straus, 1820)
**Ceriodaphnia dubia* Richard, 1894
(*Ceriodaphnia laticaudata* P. E. Müller, 1867)
**Simocephalus vetulus* (O. F. Müller, 1776)

BOSMINIDAE

**Bosmina longirostris* (O. F. Müller, 1785)

CHYDORIDAE

**Chydorus sphaericus* (O. F. Müller, 1785)
(*Pseudochydorus globosus* (Baird, 1843))
**Pleuroxus aduncus* (Jurine, 1820)
Pleuroxus denticulatus Birge, 1879
**Pleuroxus uncinatus* Baird, 1850
(*Leydigia leydigi* (Schoedler, 1863))
(*Leydigia acanthocercoides* (Fischer, 1854))
(*Disparalona rostrata* (Koch, 1841))
**Alona affinis* Leydig, 1860
(*Alona rectangula* Sars, 1862)
Alona guttata Sars, 1862
Alona quadrangularis (O. F. Müller, 1785)

MACROTHRICIDAE

(*Ilyocryptus sordidus* (Liévin, 1848))
(*Ilyocryptus agilis* Kurz, 1878)

Acknowledgements

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Centipedes and millipedes (Myriapoda) in Buckingham Palace Garden

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Summary

A survey of Myriapoda was carried out at Buckingham Palace Garden from 1995 to 1997. In an earlier survey, carried out between 1961 and 1963, only three species were identified. Of these, only *Blaniulus guttulatus* (Bosc), was not encountered in the present survey. A combined total of sixteen species of myriapods is recorded: seven centipede and nine millipede species. Most of the recorded centipedes and millipedes are common synanthropic species in England, but *Cryptops anomalans* Newport and *Cylindroiulus vulnerarius* (Berlese) have a much more restricted distribution, although both are previously recorded for the London area.

Introduction and origin of specimens

Most of the material provided for identification in this survey was collected in pitfall traps set to catch a variety of invertebrate species during the survey carried out in Buckingham Palace Garden from 1995 to 1997. Colin Plant set traps to the north and west of the Garden and these are indicated in the map already published (*antea*: 2-3) by solid black dots. Edward Milner set traps in the southern part of the Garden, one on The Island and the others clustered around The Mound; these are also indicated in the same map by the letters A, B, C and D. Other myriapod material was collected from rotten wood and objects on the ground by Colin Plant and by the Head Gardener, Mark Lane.

Results

The list below records a total of sixteen species for the Garden. Of these, fifteen were recorded during the current survey. Notes on general distribution and habitat are derived from Eason (1964), Blower (1985), and Barber & Keay (1988). An earlier survey, carried out from 1961 to 1963, recorded three myriapod species for the Garden, two of them centipedes (J. G. Blower, in Bristowe 1964). There is no indication in that account as to how or where the specimens were collected. The only millipede in that account, *Blaniulus guttulatus*, has not been encountered during the current survey.

An annotated list of centipedes and millipedes (Myriapoda) recorded in Buckingham Palace Garden

The arrangement of taxa follows that of Barber & Keay (1988) for centipedes (Chilopoda) and Blower (1985) for millipedes (Diplopoda). The species found only in the earlier survey are enclosed in round brackets; those found in both surveys are indicated with an asterisk (*). Taxa found for the first time in this survey have neither annotation. Unless otherwise stated the species are common and widespread in England. Records from Colin Plant's pitfall traps are indicated by the initials "CWP" and are listed by their alphanumeric grid reference on the map (*loc. cit.*). Records from Edward Milner's pitfall traps are indicated by the initials "JEM".

MYRIAPODA
CHILOPODA
HIMANTARIIDAE

Haplophilus subterraneus (Shaw, 1789)

Rotten oak stump 16.iv.1997; under rubbish on hard standings 17.iv.1997. Very common in woodland and frequent in grassland and suburban gardens.

SCHENDYLIDAE

Schendyla nemorensis (Koch, 1837)

Pitfalls: JEM, 28.ii.1997. A species frequently found above ground, especially in bracket fungi.

GEOPHILIDAE

* *Necrophlaeophagus flavus* (De Geer, 1778)

Pitfalls JEM: 4.v.1996; under pots etc. iv.1997; under wood on soil and under rubbish on hard standings 17.iv.1997. Generally forages on the soil surface, but frequently found within the soil, its long, narrow, flexible body allowing easy passage through the interstices between the particles.

CRYPTOPSIDAE

Cryptops anomalans Newport, 1844

Pitfalls CWP: C1, 16.iv–12.v.1997; rotten oak stump (approx. C4), 16.iv.1997. Recorded for the British Isles from only fifteen 10-km squares in Barber & Keay (1988), most clustered around London.

Cryptops hortensis Leach, 1814

Pitfalls CWP: E4, H1 iv/v.1997, JEM 25.iv.1997; rotten oak stump (approx. C4), Fletcher's yard under timber 16.iv.1997; under rubbish etc. on hard standings 17.iv.1997. A synanthropic species common in urban gardens.

LITHOBIIDAE

* *Lithobius forficatus* (Linnaeus, 1758)

Pitfalls JEM: 4.v.1996; Pitfalls CWP: E6, E4, G1, H1 16.iv–12.v.1997; Slope 1.viii.1996 (JEM); Fletcher's yard under timber, under sleeper on soil under bushes 16.iv.1997; leaf litter, under rubbish etc, on hard standings 17.iv.1997. Ubiquitous and very common in urban situations.

Lithobius microps Meinert, 1868

Pitfalls CWP: E6 west, E6 east, C1, G1, H1, M3 16.iv–12.v.1997; Fletcher's yard under timber 16.iv.1997; under wood on soil 17.iv.1997. Not notably synanthropic, nevertheless occurs commonly in built up areas.

DIPLOPODA

BLANIULIDAE

(*Blaniulus guttulatus* (Fabricius, 1798))

Recorded in the previous survey by J. G. Blower, but not encountered in the present survey. A widespread species in grassland, arable land and garden soil. It is known to damage seedlings and fleshy roots.

JULIDAE

Cylindroiulus caeruleocinctus (Wood, 1864)

Pitfalls JEM: 4.v.1996 and 25.iv.1997; Pitfalls CWP: E6 west, E6 east, C1, G1, H1, M3 16.iv–12.v.1997; under pots etc. iv.1997 (M.Lane); Fletcher's yard under wood, under sleeper on soil under bushes 16.iv.1997. Can be very damaging to root crops, particularly potatoes.

Cylindroiulus vulnerarius (Berlese, 1888)

Leaf litter 17.iv.1997. Most records in Blower (1985) are for the London area.

Cylindroiulus britannicus (Verhoeff, 1891)

Pitfall JEM: 25.iv.1997; leaf litter 17.iv.1997. Associated primarily with rotten wood and slowly decomposing leaf litter.

Ophyiulus pilosus (Newport, 1842)

Pitfalls JEM: 25.iv.1997; Pitfalls CWP: E6 east 16.iv–12.v.1997. A woodland species often found in gardens, feeding on dead vegetation.

POLYDESMIDAE

Polydesmus angustus Latzel, 1884

Pitfalls CWP: E6 east, G1, H1 16.iv–12.v.1997; rotten oak stump (approx. C4). Ubiquitous and very common in gardens where it may cause damage to roots and strawberry fruit.

Polydesmus inconstans Latzel, 1884

Pitfalls CWP: G1 16.iv–12.v.1997. Commonest in areas of cultivation, but much less common than *P. angustus*.

Polydesmus gallicus Latzel, 1884

Pitfalls CWP: E6 east 16.iv–12.v.1997; under pots etc. iv.1997; Fletcher's yard under timber 16.iv.1997. Widespread in gardens, often in very damp situations.

Brachydesmus superus Latzel, 1884

Pitfalls CWP: H1 16.iv–12.v.1997. A soil millipede, often found quite deep in garden soil.

Discussion

Myriapods are nocturnal invertebrates, hunting (centipedes) or browsing (millipedes) generally on the soil surface. During the day they are usually to be found hiding in damp, dark situations on the ground.

Most of the recorded centipedes and millipedes in Buckingham Palace Garden are common, synanthropic species in England. Although their presence here is no surprise, the absence of other widespread species in urban gardens, in particular the ubiquitous *Tachypodoiulus niger* (Leach), is probably more apparent than real.

However, two species have a more restricted distribution in the British Isles. *Cylindroiulus vulnerarius* and *Cryptops anomalans* are noted in the London area (Barber & Keay 1998; Blower 1985). The presence of *Cylindroiulus britannicus*, on the other hand, seems appropriate!

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PLATE G. Buckingham Palace Garden, London. View of the Kennels area, where pitfall traps were set. There are several rotting tree stumps here.

Photographed © by Mark Lane

Bugs (Hemiptera: Heteroptera and Auchenorhyncha) in Buckingham Palace Garden

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Abstract

Heteroptera and Auchenorhyncha were collected between 1995 and 1997 from Buckingham Palace Garden. A total of 94 species of Heteroptera and 68 species of Auchenorhyncha were recorded. Additional species recorded in the past, most during survey work in the period 1960 to 1963, bring the totals of recorded species for these groups to 100 and 76 respectively. It is considered likely that a number of further species remain unrecorded, and that the Garden may be home to approximately a quarter of the British fauna of these groups. The structural variety of the Garden and the high number of plant species present in a small area are considered to have facilitated the development of a rich fauna, but there are few resident species that are especially uncommon. One species, the anthocorid bug *Buchananiella continua*, was recorded for the first time as a resident British species during the course of the survey, but is now known to be more widely established in the London area. Three Nationally Scarce Auchenorhyncha were recorded. One, the plant hopper *Asiraca clavicornis*, is relatively common in the London area. The other two, the leafhoppers *Iassus scutellaris* and *Macropsis mendax*, are elm-feeders and their presence is suspected to reflect the historical abundance of elms in the Garden before the ravages of Dutch elm disease.

Introduction

Survey work in Buckingham Palace Garden between 1960 and 1963 (Richards 1964) recorded thirty-four species of Heteroptera and fourteen species of Auchenorhyncha. The Heteroptera were recorded by T. R. E. Southwood, but the report states that they were ‘probably not exhaustive and did not fully cover all seasons’. The Auchenorhyncha were mostly collected by O. W. Richards and identified by W. LeQuesne, and the resulting list has very much the appearance of a set of casually accumulated records rather than an attempt at systematic survey. Records of both groups include material captured at mercury-vapour light as well as by active collecting. These records are repeated in this paper, along with the much larger volume of records obtained during survey work in 1995–97.

Survey methods

A single visit was made to the Garden by the author to survey the terrestrial Hemiptera on 21 August 1997. This visit used a small number of active survey methods: sweep-netting of herbaceous vegetation and the lower foliage of trees and bushes; beating of woody vegetation; sieving of leaf litter and compost, and hand searching of significant Hemiptera habitats, especially bare and sparsely vegetated ground, tree trunks and large branches, walls, and known host-plants. The date of survey was chosen to provide the greatest number of records for a single visit. However, a single visit inevitably misses a proportion of the fauna, especially those which are adult early in the year. Additional records, covering all seasons, are available from a Malaise trap operated on The Mound from 20 April 1995 to 18 August 1997, samples from which were sorted and distributed to recorders by C. W. Plant. Aquatic Hemiptera in the lake were sampled, along with other aquatic groups, by C. W. Plant on 20 October 1995. A small number of additional records come from pitfall traps operated by E. Milner in 1995 and 1996, from light traps operated by D. Carter in 1995, and from individual captures and records made by A. Halstead, E. Hollowday, M. Lane, E. Milner and C. W. Plant.

Results

A total of 68 species of Auchenorhyncha was recorded by the present survey, of which seven were also recorded by the earlier survey. With seven species recorded by the earlier survey, and a further species recorded between the two surveys, this brings the total of Auchenorhyncha recorded from the Garden to 76 species. Ninety-four species of Heteroptera were recorded during the present survey, of which 28 were also recorded by the earlier survey. This last figure assumes that an unidentified *Notonecta* nymph recorded by the earlier survey was in fact *N. glauca*, recorded by the recent survey and by far the likeliest species to be found, and that a *Micronecta* recorded during the recent survey is *M. scholtzi*, recorded by the earlier survey and the characteristic species of lowland standing waters. Only six of the species found by the earlier survey were certainly not also found in 1995–97, bringing the total recorded from the Garden to exactly 100. These totals comprise roughly 20% of the total British Auchenorhyncha and 17% of the British Heteroptera.

Discussion

There are almost certainly more species as yet unrecorded from the Garden. There are several for which suitable habitat is apparently present. Many of these are probably, in practice, genuinely absent, because of the limited area of available habitat, its isolation from other populations, and the chance events of colonisation and extinction. A small number, however, can be predicted with more confidence as likely to be established. It is possible, for example, that one or both species of *Leptopterna* (Miridae), a characteristic genus of tall grassland, is present. These are early species which would have been missed by active survey, and though there is no reason why either or both should not have been recorded by the Malaise trap, there is equally no guarantee that they would be so caught, even if present in its immediate vicinity. Plant-hoppers (Delphacidae) may also be rather under-recorded: many members of this characteristic grassland group mature early and are not often caught by Malaise traps. The species of this family that have been captured either have multiple generations through the year or, unusually for the group, mature late and overwinter as adults.

The recorded oak fauna is noticeably incomplete, and especially lacking in early species: several additional species may be expected. Additional species would also be expected from ash and from conifers. Some tree-associated species may well have escaped detection during active survey by being concentrated in the upper canopy. In general, there is little evidence that Hemiptera are strongly stratified within tree canopies: most species seem as likely to occur on lower as on higher branches. However, this can only be the case if there are lower branches. Where there are few or no low branches, either because of shading from other trees or active management, the canopy fauna may easily be under-recorded. On the other hand, this cannot be the explanation for the most conspicuous absentees from the birch fauna: birch was easily sampled and a good representative Heteroptera fauna was recorded, but the two very common leaf-hoppers *Oncopsis flavicollis* and *O. tristis*, almost invariably found on birch even in very urban areas in the south-east, were not found. It is unlikely that both were genuinely absent and, even if they were, it is unlikely that they will long remain so.

Most of the recorded Hemiptera fauna is of fairly mobile or very mobile flying species. Some of these species may form transitory populations, and the Hemiptera fauna is likely to change somewhat from year to year as trees mature, plantings change, and weather varies. Making allowance for such year-on-year changes, and for the likely presence of permanently established species not recorded by either of the surveys, the tentative suggestion can be made that the Hemiptera fauna likely to be supported by Buckingham Palace Garden, either continuously or intermittently, over a period of several years probably includes at least a quarter of the total British fauna of Heteroptera and Auchenorhyncha.

Overall, the recorded fauna is much as might be expected from a predominantly ornamental garden. The wide range of woody species encourage a diverse associated fauna, and the spacing given to trees and shrubs in such circumstances, allowing them to shelter one another while permitting exposure to the sun, further encourages the fauna. The garden is, like many large mature gardens, structurally well suited to those species associated with habitat mosaics and transitions, and many of the more characteristic species of gardens are otherwise most often found at wood edges or in hedgerows. The fauna of herbaceous plants found in gardens tends to be rather more idiosyncratic, composed of a mixture of common polyphagous generalists and a small number of more specialised species able to benefit from one or more of the cultivated plants. The former group dominate in the list obtained from Buckingham Palace Garden, but species especially frequent on cultivated plants include the plant-bug *Campylomma verbasci* and the leafhoppers *Eupteryx florida* and *E. melissae*. The plant-bug *Europiella artemisiae*, though not in general a particularly garden-associated species, is in this case dependent on cultivated plants for its presence on the site.

Structural variety and an artificially high diversity of plant species tend to favour a fauna rich in species, especially phytophagous species, but with a poor representation of rarities, precisely as has been found in Buckingham Palace Garden. The scarcer species of Hemiptera tend to be associated with places which have nutrient-poor, drought-stressed or permanently waterlogged soils, or which have a long historical continuity of habitat and management. Precisely those soil conditions favoured by scarce Hemiptera tend to be avoided or corrected by gardeners, and historical continuity is rarely available and still more rarely practised. The opportunity for continuity is arguably greater in Buckingham Palace Garden than in many gardens, but nonetheless the present layout is not of great age by the standards of semi-natural habitats, and was imposed in the interests of ornamental appeal on an area of previously quite different character (McClintock *et al. antea*. 5–8).

There is a well-developed grassland fauna in Buckingham Palace Garden, which differentiates it from most gardens and from many ornamental parks. This fauna is largely dependent on having areas of tall grass that are infrequently mown, though it should be noted that a few species are found only, or predominantly, in close-mown areas. For those species which prefer such short-turf conditions, it is likely to be precisely the most nutrient-poor and heavily managed areas which hold the greatest potential. The closed, pure-grass sward of a well-managed lawn is of minimal value for Hemiptera, but bald patches, severely drought-stressed areas, and areas with one or more small herbs add to the potential value. The tall grassland fauna, though including a significant number of species, appears largely lacking in any of individual note: the only exception to this is the Nationally Scarce planthopper *Asiraca clavicornis*. It may be that additional uncommon species are present, and it is perhaps likeliest that such species are ground-dwelling or near ground-dwelling. However, there is little in the recorded fauna to suggest the likelihood of significant additional interest.

The fauna associated with the lake is poor in number of recorded species and apparent interest. The aquatic Hemiptera of standing waters in lowland England, away from areas of ancient wetland, tend anyway to be of rather limited value. They can, however, include many more species than have been recorded from the Garden lake. The lack of submerged macrophytes, eutrophication, the turbidity of the water, the organic character of the bed and the large number of waterfowl are probably all significant, and inter-related, factors limiting the range of species found. Additional species might be present if there were more submerged and emergent vegetation. The recorded marginal fauna is also very limited. The often rather narrow marginal fringe, extensive shading by woody vegetation, and the abundance of alien ornamental species all limit the potential of the margins, but nonetheless a rather wider range of species might be hoped for. The limited area of habitat suitable for any given species and the isolation of the site from rich wetland Hemiptera faunas may be important limiting factors.

Though the great majority of the recorded species are common and widely distributed in southern England, a few species are either scarce or otherwise worthy of specific comment. The anthocorid *Buchananiella continua* was recorded for the first time as a resident species in Britain during the course of this survey, and the formal addition of this species to the British list was the subject of a separate paper (Kirby 1999). This species has been spreading in Europe for some time (Péricart 1972) and its addition to the British list is not a matter of great surprise. It seems that it is merely fortuitous that it was first recorded from Buckingham Palace Garden: it happened that this site was the subject of intensive survey at around the time of the bug's arrival. There are unpublished records from other sites in London since the first record from the Garden, but seemingly no records as yet from outside the London area.

Three species of Auchenorhyncha recorded from the Garden are Nationally Scarce (Kirby 1992), defined as occurring in fewer than 100 ten-kilometre squares of the National Grid in Britain. None, however, is greatly surprising as a denizen of the Garden. The planthopper *Asiraca clavicornis*, though decidedly uncommon on a national scale, is relatively frequent in the London area, and occurs in a quite wide range of sites, including, and perhaps especially, those prone to disturbance or recovering from past disturbance. The two leafhoppers *Iassus scutellaris* and *Macropsis mendax* both live on elm, and both have seemingly coped well in the aftermath of Dutch elm disease, thriving on young shrubby re-growth. Both are strongly south-eastern in distribution and, though neither is usually associated with the urban area of London, it is well within their usual range. Neither species obviously requires more than the presence of the foodplant in reasonable quantity and in the absence of dense shade.

The presence of these two scarce elm-feeding species, along with the local *Anthocoris gallarumulmi* and the somewhat less local *Ribautiana ulmi*, mean that elm is arguably the most important of the woody species in the Garden for Hemiptera. Some other woody plants support more species (willows, poplars, birch and oak having particularly large associated faunas), but these are mostly common species, which can occur almost wherever the host tree grows. The importance of elm in the Garden may well reflect the large number of elms present prior to Dutch elm disease (McClintock & Lane *antea*. 45–48), the remaining fauna having survived the death and removal of the mature trees.

A comparison of the species list from the recent survey with that from the earlier survey provides little evidence of change in the fauna over the intervening years. However, in some measure the lack of detectable change results from the obvious incompleteness of the earlier list, and the consequent uncertainty as to what else might have been present, but unrecorded. There must have been some changes: two of the species recorded by the recent survey were not established in Britain in the 1960s, and several others have spread in recent decades and are unlikely to have been established in the Garden at the time of the earlier survey.

An annotated list of bugs (Heteroptera and Auchenorhyncha) recorded in Buckingham Palace Garden

Nomenclature of Auchenorhyncha follows Le Quesne & Payne (1981); that of Heteroptera follows Aukema & Rieger (1995–99). Within each of these major subdivisions, species are grouped into families. Families are placed in alphabetical order, and species in alphabetical order within families. Species found in the earlier survey, but not in the present study, are enclosed in round brackets. A single record made between the two surveys (*Empoasca pteridis*) is treated as belonging to the earlier survey. Taxa recorded in both surveys are indicated with an asterisk. Taxa with neither annotation were found for the first time in the present survey.

HETEROPTERA

ACANTHOSOMATIDAE

Acanthosoma haemorrhoidale (Linnaeus, 1758)

A common shieldbug which feeds on the fruits of rosaceous trees and shrubs, and is usually associated with hawthorn. Several were captured from shrubs during active survey of the Garden in 1997.

Elasmostethus interstinctus (Linnaeus,1758)

A common shieldbug, usually feeding on fruiting birches. It was found commonly on birch in the garden during active survey in 1997.

Elasmucha grisea (Linnaeus, 1758)

A common shieldbug on birch, less often found on alder. It was found commonly on birch in the Garden during active survey in 1997, and was also captured by the Malaise trap in 1996.

ANTHOCORIDAE

(*Acompocoris pygmaeus* (Fallén, 1807))

A common species on conifers, the single individual of this species recorded by the earlier survey was found on oak. This leaves some scope for doubt as to its status in the Garden, but suitable foodplants were and are present, and it may well be a long-term resident.

* *Anthocoris confusus* Reuter,1884

A common bug on shrubs and trees in a wide range of habitats: recorded from the Garden by active survey in 1997, and by both the Malaise trap and light-trapping in 1995. It is probably widely distributed in the Garden but is clearly much less common than *A. nemoralis*, a species of similar ecology and often found with it.

* *Anthocoris gallarumulmi* (De Geer, 1773)

A local bug which feeds on aphids within leaf-galls on elm. It was captured in the Garden by the Malaise trap in 1996. It is almost certainly established, especially as it was also recorded by the earlier survey, and is one of a quite impressive range of elm-feeding species recorded from the Garden during the survey.

Anthocoris nemoralis (Fabricius, 1794)

A very common predacious bug occurring on shrubs and trees: found commonly throughout the Garden on a wide range of woody species during active survey in 1997, and also captured by the Malaise trap in 1995, 1996 and 1997.

* *Anthocoris nemorum* (Linnaeus, 1761)

A very common predacious bug found amongst herbaceous vegetation and on low shrubs in a very wide range of habitats. It was found commonly throughout the Garden during active survey in 1997, and was also captured by the Malaise trap in 1995.

Buchananiella continua (B. White, 1880)

Recorded from Britain as a resident species for the first time during this survey, and formally added to the British list by Kirby (1999). It has been spreading for some time in mainland Europe. It lives amongst accumulations of dry leaf litter in trees and shrubs. Its capture for the first time in Britain in Buckingham Palace Garden was probably fortuitous: it has since been recorded from other localities in the London area, and may well have been established for some time before being recognised. It was captured in the Malaise trap in the Garden in 1995, 1996 and 1997, on dates ranging from 7 May to 21 October, and by light-trapping in 1995. Though there may be many pockets of suitable habitat for this species within the Garden, the only place where breeding can be confidently believed to take place is within the Recycling Centre, where *B. continua* was found, during active survey in 1997, to be quite common amongst loosely stacked branches with attached leaves.

Orius majusculus (Reuter, 1879)

A common predacious bug found on low shrubs and tall herbaceous vegetation in a wide range of habitats. It was captured in small numbers during active survey in 1997, and by the Malaise trap in the same year.

* *Orius niger* (Wolff, 1811)

A small predacious bug, often abundant on low flowery vegetation in full sunshine, and often especially frequent on flowers of mints *Mentha* spp. It was found commonly by lightly sweeping plants in a herbaceous border during active survey in 1997.

Orius vicinus (Ribaut, 1923)

A common predacious bug amongst tall herbaceous vegetation and shrubs in a wide variety of habitats, found fairly commonly throughout the Garden during active survey in 1997, and also captured by the Malaise trap and by light-trapping in 1995.

Temnostethus gracilis (Horváth, 1907)

A common bug which lives on trunks and branches of trees, favouring those in sun or half-shade. It was found in moderate numbers on trees of several species in the Garden during active survey in 1997.

Xylocoris galactinus (Fieber, 1836)

A common species, but confined to artificially warm habitats such as manure and compost heaps. It was found fairly commonly amongst composting vegetation in the Recycling Centre during active survey in 1997.

COREIDAE

Coriomeris denticulatus (Scopoli, 1763)

A ground-dwelling species which feeds on black medick *Medicago lupulina* on dry, well-drained ground, and which is fairly common in the south-east of Britain. It was recorded from the garden only as a Malaise trap capture in 1995. It may be an established species, but no good stands of its foodplant were seen for investigation during active survey in 1997.

CORIXIDAE

* *Callicorixa praeusta* (Fieber, 1848)

A common water boatman in a wide range of still waters, and a very mobile species which can rapidly colonise newly or temporarily suitable habitats: recorded from The Lake by C.W. Plant in 1995.

Cymatia coleoptrata (Fabricius, 1776)

A small and rather local water-boatman, usually found in clear still water with abundant weeds. Its presence in The Lake, where it was captured by C.W. Plant in 1995, is somewhat anomalous: the aquatic bugs are otherwise a rather small assemblage of very common species, and *C. coleoptrata* is not a species to which the lake is obviously suited.

(*Hesperocorixa sahlbergi* (Fieber, 1848))

A common water boatman in still waters with a high organic content, and tolerant of a higher density of weed than most of its family. It was recorded at light in the earlier survey, but was not captured from The Lake. This is a very mobile species, and can be caught in light-traps some distance from water, so may never have been established in the Gardens. On the other hand it may have been established in The Lake, and could still be so, if only locally and in small numbers.

(*Micronecta scholtzi* (Scholtz, 1860))

Recorded as being abundant in the lake at the time of the earlier survey, it was probably still present in the 1990s; a *Micronecta* recorded by E. Hollowby from The Lake probably belonging to this species. It is the characteristic member of the genus in lowland standing waters.

* *Sigara dorsalis* (Leach, 1817)

The commonest of the water boatmen in southern Britain, and one which can live in almost any still or slow-flowing water body which is not grossly polluted. It was captured from The Lake by C.W. Plant in 1995.

Sigara distincta (Fieber, 1848)

A common water boatman of still and very slow water bodies, usually favouring those with fairly deep water. It was captured from The Lake by C.W. Plant in 1995.

Sigara falleni (Fieber, 1848)

A common water boatman, found in still and slow-flowing waters, reaching very high densities in such water bodies where there is an extensive bare, silty bed. It was captured from The Lake by C.W. Plant in 1995.

HYDROMETRIDAE

Hydrometra stagnorum (Linnaeus, 1758)

A very common insect on water margins, walking over the water surface in extreme shallows and over wet ground amongst marginal vegetation. It was captured from The Lake by C.W. Plant in 1995, and also in pitfall traps set near the lake margin by E. Milner in 1996 and 1997.

LYGAEIDAE

Drymus sylvaticus (Fabricius, 1775)

A common ground-dwelling bug found amongst dry leaf litter, often beneath tall herbaceous plants or in partial shade: a few were found amongst loose leaf litter around trees in the Garden during active survey in 1997, and further individuals were captured by the Malaise trap in 1995 and 1997.

Kleidocerys resedae (Panzer, 1797)

A common bug which feeds on birch, especially the developing seeds, and is also found on alder and rhododendron. It was found abundantly on birch in the Garden during active survey in 1997, and was also captured by the Malaise trap in 1995 and 1996.

Nysius ericae (Schilling, 1829)

A common bug in dry places with low and usually incomplete vegetation cover. A few were found in particularly dry areas of close-mown grassland in the Garden during active survey in 1997.

Peritrechus geniculatus (Hahn, 1832)

A common bug in southern counties, and characteristic of fairly dense dry grassland. Several were captured by sweeping tall grassland in the Garden in 1997, and it was also recorded from the Malaise trap in 1995.

* *Scolopostethus affinis* (Schilling, 1829)

A ground-dwelling bug sometimes found amongst nettle *Urtica dioica* with its relative *S. thomsoni*, but more often in dry open situations, often with incomplete vegetation cover, such as ruderal habitats, open grassland, and coastal habitats. It was found on the ground in dry grassland in the Garden during active survey in 1997, was captured by the Malaise trap in 1995, 1996 and 1997, and was also taken by a pitfall trap in 1997.

Scolopostethus thomsoni Reuter, 1874

A common ground-dwelling bug, particularly associated with dense beds of nettle *Urtica dioica*, but also found amongst other tall herbaceous vegetation, often in partial shade. A few individuals were captured amongst leaf litter in the shade of bushes in the Garden during active survey in 1997.

Stygnocoris fuligineus (Geoffroy, 1785)

A small ground-dwelling bug found in fairly dry places amongst grassland or ruderal vegetation. A few individuals were found in the Garden in areas of close-mown grass during active survey in 1997.

MICROPHYSIDAE

Loricula elegantula (Bärensprung, 1853)

A small, common predacious bug which lives on the trunks and branches of broadleaved trees. Individuals were found on various trees throughout the Garden during active survey in 1997.

MIRIDAE

Atractotomus parvulus Reuter, 1878

A conifer-feeding bug, usually associated with Scots pine and fairly common in southern Britain. It was recorded in the Garden only by light-trapping in 1995. This species is an efficient nocturnal disperser and is quite frequently captured by light-traps in places well-removed from conifers, and so cannot be regarded as certainly established in the Garden, but its foodplant is present, so a resident population is likely.

* *Blepharidopterus angulatus* (Fallén, 1807)
A common bug found on a variety of trees, but especially frequent on birch. It was captured in small numbers from birch in the garden during active survey in 1997.

(*Blepharidopterus diaphanus* (Kirschbaum, 1855))
Reported from willow by the earlier survey, this somewhat local bug is especially frequent on white willow *Salix alba*. It may still be present in the Garden, but the preferred host is not, leaving room for doubt.

Calocoris norvegicus (Gmelin, 1790)
A very common plant bug which is polyphagous on herbaceous plants, including some arable crops. A few individuals were captured from a herbaceous border in the Garden during active survey in 1997.

Campylomma verbasci (Meyer-Dür, 1843)
A small and very local plant bug, polyphagous on tall herbaceous plants, seemingly with a particular predilection for hollyhocks *Alcea rosea* and mulleins *Verbascum* spp. It is most frequent in the London area, and more likely to occur in gardens or on garden escapes on derelict land than in more natural habitats. It was captured in the Garden by C.W. Plant in July 1996, and additional specimens were taken by the Malaise trap in 1995, 1996 and 1997.

Campyloneura virgula (Herrich-Schäffer, 1836)
A common plant bug which lives on various shrubs and the low branches of trees. It appears to be especially frequent on hazel, but can develop large populations on the lower branches of sycamore. It was captured in the Garden only by the Malaise trap in 1995: it is a quite frequent garden species, and it is surprising that it was not found more commonly.

Capsus ater (Linnaeus, 1758)
A common and characteristic grassland species, found in a very wide range of grassy habitats, though absent from short turf. It was captured in the Garden by C.W. Plant in 1996 and by the Malaise trap in 1997. It may be reasonably frequent in the taller grassland, active survey work in 1997 being well past the peak of activity for this relatively early species.

Chlamydatus pullus (Reuter, 1870)
A small, fairly common ground-dwelling bug found amongst low open vegetation, in short grassland or ruderal habitats. It was fairly frequent, if rather local, in close-mown turf in the Garden in August 1997.

Chlamydatus saltitans (Fallén, 1807)
Of similar status and habitats to *C. pullus*, and often found with it. It, too, was found amongst short turf in the Garden, but in smaller numbers than its congener.

Compsidolon salicellum (Herrich-Schäffer, 1841)
A fairly common bug found on bramble, often in at least moderate shade, and one of the few bramble-associated species to occur on thin straggling bramble in dense woodland shade. A small number of *C. salicellum* was found on bramble in light tree shade in the Garden during active survey in 1997.

* *Deraeocoris lutescens* (Schilling, 1837)
A common plant bug found on a wide range of broadleaved trees and shrubs. It was found commonly throughout the garden during active survey in 1997, and additional individuals were caught C.W. Plant in 1997, and by the Malaise trap in 1995 and 1997.

Deraeocoris ruber (Linnaeus, 1758)
A common bug in southern counties, found amongst tall herbaceous vegetation, especially at vegetation transitions such as hedgerows and wood margins. It is often a common species in gardens. It was found in moderate numbers and widespread across the Garden during active survey in 1997.

* *Dicyphus errans* (Wolff, 1804)

A common bug, polyphagous on plants with secretory hairs. Several were captured by lightly sweeping a herbaceous border in the Garden during active survey in 1997.

Dicyphus stachydis Sahlberg, 1878

A common bug, usually found on hedge woundwort *Stachys sylvatica*, though with occasional records from other plants. It has been captured only once during the survey, by the Malaise trap in 1996, and though it is not a great wanderer and is likely to be established in the garden, it may well be rather local.

Europiella artemisiae Becker, 1864

A common bug which feeds on *Artemisia* spp. A number was captured from cultivated *Artemisia* in a herbaceous border during active survey in 1997.

* *Heterotoma merioptera* (Scopoli, 1763)

A characteristic and distinctive species of tall herbaceous vegetation, often found with *Deraeocoris ruber* at habitat transitions such as hedges and wood margin and, like that species, often common in gardens. It was found fairly commonly in the Garden during active survey in 1997, and was also caught by C.W. Plant in 1996 and by the Malaise trap in 1995 and 1996.

Liocoris tripustulatus (Fabricius, 1781)

A common plant-bug, usually feeding on nettle *Urtica dioica* but also recorded from several species of garden plant. Several were caught by lightly sweeping a herbaceous border in the garden during active survey in 1997, but the host plant could not be determined.

* *Lygocoris contaminatus* (Fallén, 1807)

A common plant bug, feeding chiefly on birch, though occasionally recorded from other trees. It was found commonly on birch in the Garden during active survey in 1997.

* *Lygocoris pabulinus* (Linnaeus, 1761)

A very common species, and characteristic of habitat mosaics and transitions, the bugs being associated with tall herbaceous vegetation but needing woody stems in which to lay their eggs. It was found in small numbers at scattered locations in the Garden during active survey in 1997, and was also captured by the Malaise trap in 1995.

Lygocoris spinolae (Meyer-Dür, 1841)

A common plant bug of tall herbaceous vegetation and low scrub, often frequent on large banks of bramble in late summer. Several were swept from shrubs in the Garden during active survey in 1997.

Lygocoris viridis Fallén, 1807

Lime is the chief foodplant of this common plant-bug, but it also occurs on sycamore. Captured only by the Malaise trap, with single individuals in 1996 and 1997, this species is almost certainly established in the Garden, but the possibility that the records are of wanderers cannot be ruled out.

Lygus rugulipennis Poppius, 1911

A common plant bug, polyphagous on herbaceous plants, including some arable crops, and especially frequent on members of the Chenopodiaceae. Small numbers were captured by sweeping tall grassland during active survey in 1997.

* *Malacocoris chlorizans* (Panzer, 1794)

A common bug found on leaves of shrubs and the low branches of broadleaved trees, especially in sheltered situations. Several were found during active survey of the Garden in 1997, at widely scattered points. Such widespread records are usual for this bug, which tends to occur at fairly low density.

* *Megacoelum infusum* (Herrich-Schäffer, 1837)

A fairly common oak-feeding species, though far from universally found where its host grows and sometimes occurring in rather small numbers. It was captured by the Malaise trap in 1995, but has not otherwise been recorded by the survey.

* *Monalocoris filicis* (Linnaeus, 1758)

A common bug which feeds on a wide range of ferns, including bracken *Pteridium aquilinum*. It was recorded in small numbers by active survey in 1997, and also caught in the Malaise trap in 1995.

Notostira elongata (Geoffroy, 1785)
A very common species of tall grassland: captured in moderate numbers by sweeping areas of taller grass during active survey in 1997.

Orthops campestris (Linnaeus, 1758)
A common plant bug which feeds on a wide range of umbellifers, including such common species as cow parsley *Anthriscus sylvestris* and hogweed *Heracleum sphondylium*, feeding predominantly on the flowers and seed-heads. It was captured by sweeping amongst tall herbaceous vegetation at the margin of grassland during active survey of the Garden in 1997.

(*Orthotylus bilineatus* (Fallén, 1807))
A somewhat local bug, usually found on aspen *Populus tremula*, and only occasionally on other species of poplar. In the earlier survey it was found on young poplars, and was thought to have been introduced as eggs with the trees. This species may now be absent from the Garden.

Orthotylus ericetorum (Fallén, 1807)
A fairly common species of plant-bug, but restricted in distribution by its food-plants, heather *Calluna vulgaris* and heaths *Erica* spp., and therefore largely a species of heathland. It was found in small numbers on cultivated heathers in the Garden during active survey in 1997, and though not the first time that this species has been recorded in such circumstances, there are still rather few records of it from cultivated forms of heather, and it may well be under-recorded in such circumstances.

Orthotylus flavinervis (Kirschbaum, 1856)
A fairly common tree-dwelling bug, most often associated with alder, but not infrequently, and perhaps increasingly, found on sycamore. It was captured in the Garden only by light-trapping in 1995, but it may well be an established species.

Orthotylus flavosparsus (Sahlberg, 1842)
A common plant-bug, feeding on members of the Chenopodiaceae. It was captured in small numbers during active survey of the Garden in 1997, and was seemingly established at the time, but colonies of this highly mobile insect can be transitory.

* *Orthotylus marginalis* Reuter, 1883
A common bug on willows. During the recent survey, it was recorded in the Garden only by the Malaise trap in 1995. It is probably well-established, since a substantial willow fauna has been recorded and it would be unusual if *O. marginalis* were missing from it, especially in view of the record from the earlier survey. It is a relatively early species, and active survey in 1997 may have been too late in the year to record it.

Orthotylus nassatus (Fabricius, 1787)
A common tree-dwelling bug, usually feeding on limes but occasionally recorded from other trees. Several were captured during active survey in 1997.

* *Orthotylus ochrotrichus* Fieber, 1864
A common bug on shrubs of various species, often found at wood margins, hedgerows and other transitional and marginal habitats, and frequently common in well-structured gardens. It was found to be widespread and fairly common in the Garden during active survey in 1997, and was also captured by the Malaise trap in 1995.

* *Pantilius tunicatus* (Fabricius, 1781)
A somewhat local large plant-bug, most frequently found on birch and alder, feeding especially on the developing seeds, but also recorded from hazel. It becomes adult rather late in the year, and may be somewhat under-recorded as a consequence. A single nymph was found on birch during active survey in 1997, and a further individual was captured by M. Lane in the same year.

* *Phytocoris dimidiatus* Kirschbaum, 1856
A common tree-dwelling bug, active at night and spending the day on the trunk, branches and twigs. During the recent survey of the Garden, it was captured only by the Malaise trap in 1997. It is likely to be well-established, and the failure to record it during active survey in 1997 is surprising. The earlier survey reported this species as commoner than

P. tiliae, and noted that this was the reverse of the normal situation. The suggestion was made that *P. dimidiatus*, being the darker of the two species, was more effectively camouflaged against smoke-blackened trunks and branches. It is interesting, therefore, that normality appears to have been achieved during the intervening years with their increased pollution control, *P. tiliae* being overwhelmingly the commoner of the two during the recent survey.

Phytocoris longipennis Flor, 1861

A common bug on a range of broad-leaved trees, and, nationally, the most frequently captured of its genus. It was found fairly commonly throughout the Garden and on a wide range of trees during active survey in 1997, and was also caught by the Malaise trap in 1997.

* *Phytocoris tiliae* (Fabricius, 1777)

A common species on broadleaved trees, with similar habits to the preceding two species. It appears to be the commonest tree-dwelling member of the genus in the Garden, being found commonly during active survey in 1997, and also captured by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995.

Phytocoris ulmi (Linnaeus, 1758)

A common bug, found on shrubs rather than trees, and especially associated with hawthorn. It was found in small numbers during active survey of the Garden in 1997, and also captured by the Malaise trap in 1995.

Phytocoris varipes Boheman, 1852

A common and characteristic species of dry grassland, though absent from short turf. It was found commonly by sweeping taller areas of grassland in the Garden in 1997.

* *Pinalitus cervinus* (Herrich-Schäffer, 1841)

A common and variable plant-bug which feeds on a rather diverse range of flowering trees and climbers, particularly important hosts being holly, ivy and lime. It was found in moderate numbers, but as scattered individuals, during active survey in 1997, and was also caught by the Malaise trap in 1995, 1996 and 1997.

Pithanus maerkeli (Herrich-Schäffer, 1838)

A common and characteristic species of dry grassland, found in moderate numbers by sweeping areas of taller grassland in the garden during active survey in 1997.

Plagiognathus arbustorum (Fabricius, 1794)

A very common plant-bug, polyphagous on herbaceous plants, and especially frequent on nettle *Urtica dioica* and amongst tall ruderal vegetation. It also feeds on a range of cultivated plants and is often common in gardens. It was found to be widespread and fairly common in the garden during active survey in 1997: it was also caught by C.W. Plant in 1996, and by the Malaise trap in 1995 and 1996.

Plagiognathus chrysanthemi (Wolff, 1804)

A very common bug of dry open habitats, including ruderal vegetation and dry grassland. It was found commonly by sweeping areas of taller grassland in the Garden during active survey in 1997.

* *Psallus falleni* (Reuter, 1883)

A common bug, feeding on birch: found commonly on its usual host during active survey of the Garden in 1997.

Psallus haematodes (Gmelin, 1790)

A common willow-feeding bug, found commonly on its usual foodplants near The Lake during active survey of the Garden in 1997.

Psallus perrisi (Mulsant & Rey, 1852)

A very common bug on oak. Captured in the Garden only by the Malaise trap in 1995, but probably well-established and, as an early-maturing species, likely to have been missed by active survey in 1997.

(*Psallus salicis* (Kirschbaum, 1856))

A fairly common species on alder, reported as abundant on this tree at the time of the earlier survey, and quite possibly still present in the Garden.

Psallus varians (Herrich-Schäffer, 1841)
A common bug, usually feeding on oak and perhaps confined to this host as a nymph, but wandering to other trees and shrubs as an adult. A few individuals were beaten from shrubs during active survey of the Garden in 1997, but survey was rather late in the year for this species, and would probably have recorded only the last stragglers.

(*Pseudoloxops coccineus* (Meyer-Dür, 1843))
This somewhat local species is found on large fruiting ashes, and was reported as being common on larger ash trees at the time of the earlier survey, when it was also captured at light. It tends to be somewhat under-recorded because a large proportion of the population lives high in the trees, and may still be present in the Garden.

* *Stenodema laevigata* (Linnaeus, 1758)
A common species of tall grassland, though tending to avoid very dry areas and tolerant of some shade. It was captured by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995, but was, surprisingly, not found during active survey in 1997.

Stenotus binotatus (Fabricius, 1794)
A common and characteristic species of tall grassland, found in large numbers by sweeping taller grassland during active survey of the Garden in 1997 and also recorded by C.W. Plant in 1996, and by both the Malaise trap and light trap in 1995.

NABIDAE

Himacerus apterus (Fabricius, 1798)
A common arboreal damsel-bug, found amongst the foliage of a wide range of broadleaved trees and shrubs, especially in sheltered sunny situations. It was beaten in moderate numbers from woody vegetation throughout the Garden during active survey in 1997.

* *Himacerus major* (A. Costa, 1842)
A common ground-dwelling damsel-bug of dry unshaded situations, especially frequent in open dry grassland, ruderal vegetation and coastal habitats. It was found in small numbers in areas of tall dry grassland during active survey of the Garden in 1997, and was also captured by the Malaise trap in 1995.

Himacerus mirmicoides (O. Costa, 1834)
A common ground-dwelling damsel-bug in dry open habitats, especially those with partial vegetation cover, including dry grassland with a closed sward. Several were found in tall dry grassland during active survey of the Garden in 1997, and it was also captured by the Malaise trap in the same year.

Nabis ferus (Linnaeus, 1758)
A common damsel-bug of dry open habitats, including dry grassland, ruderal vegetation and cultivated land. A very mobile species and a rapid coloniser, it is the most characteristic damsel-bug of frequently disturbed land. Several were captured by sweep-netting areas of tall grassland during active survey of the Garden in 1997.

Nabis limbata (Dahlbom, 1851)
A common damsel-bug of densely-vegetated but unshaded places, especially frequent in damp grassland, wetland, and water margins. It was found commonly amongst marginal vegetation by The Lake during active survey of the Garden in 1997.

Nabis rugosus (Linnaeus, 1758)
A common and characteristic damsel-bug of dry grassland, found in grassy places in a wide range of habitats. It was swept commonly from taller grassland during active survey of the Garden in 1997.

NEPIDAE

Nepa cinerea Linnaeus, 1758
A common water bug found amongst dense weed and at the margins of a wide range of still and slow-flowing waters. One was found in the compost heap by a gardener in 1995.

NOTONECTIDAE

Notonecta glauca Linnaeus, 1758
The commonest of the British backswimmers, this bug is found in a wide range of still and slow-flowing waters. It was captured from The Lake by C.W. Plant in 1995. The

earlier survey reported nymphs of *Notonecta* sp. in The Lake: almost certainly these, too, were *N. glauca*.

PENTATOMIDAE

Aelia acuminata (Linnaeus, 1758)

A characteristic species of dry grassland, this somewhat local shieldbug has increased significantly in recent years, and is probably a beneficiary of recent climate change. Tending in the past to be a species of long-established grassland and heath edge, it has both increased in range and spread to a greater extent into secondary habitats. It was found in small numbers by sweeping areas of tall grassland during active survey of the Garden in 1997, and was also captured by the Malaise trap in 1995.

Eysarcoris fabricii (Kirkaldy, 1904)

A common shieldbug which, though somewhat prone to fluctuation in numbers, has shown a gradual increase over the course of the twentieth century. It feeds chiefly on labiates, and is most frequently associated with hedge woundwort *Stachys sylvatica* or black horehound *Ballota nigra*. Several were caught in the Garden during active survey in 1997, and one was also captured by M. Lane in the same year.

Palomena prasina (Linnaeus, 1761)

Formerly a common species in south-western counties but decidedly local further north and east, this shieldbug has increased considerably in frequency in recent years, and has become a common species of hedgerows and, increasingly, of gardens through much of southern England. It is characteristically a species of sheltered habitat transitions and mosaics, such as wood margins and hedgerows, but can also occur in more open situations provided there is shelter from tough-stemmed herbaceous plants or low bramble. It was found in small numbers on shrubs during active survey of the garden in 1997, and was also caught by the Malaise trap in the same year. It is possible that this was the first year of occupancy of the garden by this species: it is certainly likely that it has not been long established there.

Pentatoma rufipes (Linnaeus, 1758)

A common tree-dwelling shieldbug, found on a wide range of broadleaved trees, and occurring both in established woodland and on more isolated trees, including urban street trees. Several were captured during active survey of the garden in 1997, and it was also taken by light-trapping in 1995: it is likely to be well-established and common, but because much of the population is out of reach in the tree canopy and the bug tends to occur at fairly low density, captures made by active survey rarely give a fair impression of its abundance at a site.

Podops inuncta (Fabricius, 1775)

A ground-dwelling shieldbug found in dry grassland and other open-structured and unshaded habitats. It is fairly common, but easily overlooked and rather under-recorded. A single individual was captured from the Garden by E. Milner in 1996.

REDUVIIDAE

Empicoris vagabundus (Linnaeus, 1758)

A long-legged, slow-moving predator found in dry sheltered places such amongst ivy on trees and walls, amongst dense twigs in shrubs, and under cobwebby overhangs on walls and buildings. It is a fairly common species, but often overlooked. It was found in small numbers on the boundary wall of the Garden during active survey in 1997, and may well be more widely established in suitable situations.

SALDIDAE

Chartoscirta cincta (Herrich-Schäffer, 1841)

A common shore-bug found amongst tall wetland vegetation in marshes and, especially, at water margins. It was found in small numbers amongst marginal vegetation by The Lake during active survey in 1997.

Saldula saltatoria (Linnaeus, 1758)

A common shore-bug, found on damp bare mud, especially at water margins but also in small and often temporary patches of habitat created by disturbance in damp places. It was captured by the Malaise trap in 1995 and is almost certainly established at the margin of The Lake but, surprisingly, was not found there during active survey in 1997.

TINGIDAE

Acalypta parvula (Fallén, 1807)

A small moss-feeding lace-bug found commonly in dry unshaded habitats, especially dry grassland. Several were captured during active survey of the Garden in 1997 by sifting moss taken from amongst areas of taller dry grassland.

Tingis ampliata (Herrich-Schäffer, 1838)

A common lace-bug on creeping thistle *Cirsium arvense*: found by searching its host-plant in tall grassland during active survey of the Garden in 1997.

AUCHENORHYNCHA

CERCOPIDAE

Aphrophora alni (Fallén, 1805)

A common species, polyphagous on trees and shrubs, and most frequent at wood margins, hedgerows and habitat mosaics. It was captured in moderate numbers on trees and shrubs throughout the Garden by active survey in 1997, and was also caught by the Malaise trap in 1995.

Neophilaenus lineatus (Linnaeus, 1758)

A very common grassland species, occurring on a wide range of grass species in a wide range of habitats and vegetation structures, but not found in close-mown or close-grazed grassland. It was captured in moderate numbers amongst taller areas of grassland by active survey in 1997, and occasional individuals, probably wanderers, were found away from the grassland. It was also caught by the Malaise trap in 1995, 1996 and 1997.

Philaenus spumarius (Linnaeus, 1758)

A very common species, polyphagous on herbaceous plants, and a frequent species in gardens. It was found to be common throughout the Garden during active survey in 1997, and was captured by the Malaise trap in 1995, 1996 and 1997.

CICADELLIDAE

Agallia consobrina Curtis, 1833

This is a common species, usually found amongst tall herbaceous vegetation, especially tall ruderal vegetation and habitat transitions such as hedges and wood margins. It was captured by active survey in the Garden in 1997, when it was found in small numbers in areas of tall grass and herbs.

Agallia ribauti Ossiannilsson, 1938

A common species in the south-east, found in dry grassland and disturbed ground, especially amongst short or open-structured vegetation. It was captured by active survey in the Garden in 1997: it was found in dry grassland on the mound, and perhaps occurs elsewhere in dry grassland.

(*Aguriahana stellulata* (Burmeister, 1841))

A somewhat local leafhopper, recorded from a number of trees but perhaps most frequently found on ornamental *Prunus* spp. in parks and gardens. It was recorded at light by the earlier survey, and is not certainly known to have been established in the Garden, though it is quite likely that it was. Suitable trees were specifically searched for this species during active survey in 1997, without success. However, it can be a somewhat elusive species, often present in small numbers, and may still be established.

Alebra albostriella (Fallén, 1826)

This is a common species on oak, and occurs even on isolated trees. It was captured by active survey in 1997, and by the Malaise trap in 1995 and 1996.

Alebra wahlbergi (Boheman, 1845)

This is a generally common species, recorded from a number of shrub species, but most consistently found on elm. It was captured by the Malaise trap in 1995 and 1996 and is probably well-established on woody vegetation in the Garden, with elm the most likely host.

* *Allygus mixtus* (Fabricius, 1794)

A common species, adults being found on trees and shrubs, usually where these occur in mosaic with grassland and herbaceous vegetation. The adults are very mobile, and are frequently caught by trapping methods such as Malaise traps. It was recorded commonly on trees by active survey in the Garden in 1997, by the Malaise trap in 1995, 1996 and 1997, and by the light trap in 1995.

Allygus modestus (Scott, 1876)

This common species is similar in ecology to *A. mixtus*, and often occurs with it. In Buckingham Palace Garden, *A. modestus* appears to be significantly the less common of the two. It was found to be widespread in the Garden during active survey in 1997, and was also caught by the Malaise trap in 1995 and 1997, and by light trapping in 1995.

(*Alnetoidea alneti* (Dahlbom, 1850))

A common, polyphagous tree-dwelling leafhopper, recorded from hawthorn by the earlier survey. It is likely still to be present in the Garden, especially amongst woody vegetation near The Lake, but it is surprising that it was not captured either by active survey in 1997 or by the Malaise trap.

Aphrodes albifrons (Linnaeus, 1758)

A common species, typically found in dry grassland but occurring in a wide range of additional habitats provided they are not heavily shaded. It was found fairly commonly in taller grassland by active survey in 1997, and was also caught by the Malaise trap in 1995 and 1997.

Aphrodes makarovi Zakhvatkin, 1948

A very common polyphagous species found in a very wide range of habitats, including arable land and gardens. Though predominantly ground-dwelling, it is quite frequently caught in Malaise and other traps. Small numbers were found at the margin of a herbaceous border in the Garden during active survey in 1997. It is surprising that it was not more frequently and more widely found during the survey, and would be expected to be widespread and common throughout the garden.

Arboridia ribauti (Ossiannilsson, 1937)

A somewhat local oak-feeding species, found both in woodland and on more isolated trees. It was captured by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995, and is almost certainly an established species on oak in the Garden. The records from this survey suggest that it may live relatively high in the trees and be overlooked by active ground-based survey methods.

Arthaldeus pascuellus (Fallén, 1826)

This is a very common grassland species, though intolerant of close-grazed or close-mown grass. It was found commonly in areas of taller grassland by active survey in 1997, and was also captured by C.W. Plant in 1996.

Balclutha punctata (Fabricius, 1775)

A fairly common species, usually found in grassland and amongst herbaceous vegetation in woodland rides, wood margins, and other transitional or mosaic habitats. It was found in moderate numbers by sweeping around trees on The Mound in 1997, and was also caught by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995.

Cicadula persimilis (Edwards, 1920)

This is an unusual member of its genus, in that it can occur in both wetland and dry grassland: other *Cicadula* spp. are exclusively wetland species, feeding on rushes and sedges. *C. persimilis* is probably usually associated with sedges when it occurs in dry grassland, but may not always be so. During the recent survey, it was captured only by the Malaise trap in 1995. It is not known where in the Garden the species originated, but it is probably likelier that it is established here than that the individual recorded was a wanderer.

Cicadula quadrinotata (Fabricius, 1794)

A common species in wetlands and at water margins, associated with rushes and sedges. It was found commonly amongst marginal vegetation by The Lake in 1997.

Deltocephalus pulicaris (Fallén,1806)
A common and characteristic dry grassland species, especially frequent on short grassland and on somewhat acid soils. it was captured by active survey in 1997, moderate numbers being caught by sweeping in dry grassland, both tall and close-mown.

(*Edwardsiana avellanae* (Edwards, 1888))
A common species on hazel, and likely still to be present in the Garden.

* *Edwardsiana crataegi* (Douglas, 1876)
A common hawthorn-feeding species, to be expected wherever the host plant grows in southern England. It was captured by active survey in the Garden in 1997.

* *Edwardsiana hippocastani* (Edwards, 1888)
This is a common shrub- and tree-feeding species, recorded hosts including elm, alder and hazel. In the recent survey, it was captured only by the Malaise trap in 1995. It is probably established in the Garden, but its abundance and hosts are uncertain.

Edwardsiana ishidai (Matsumura, 1932)
A common shrub- and tree-feeding species, associated particularly with elm and hazel. Captured by the Malaise trap in 1997, this species is probably established in the garden, but its abundance and hosts are uncertain.

Edwardsiana lethierryi (Edwards, 1881)
A common species recorded from a wide range of shrubs and trees. It was found abundantly in the Garden in 1997, and on a wide range of trees. Curiously, it was never captured by the Malaise trap, whereas three other species of the genus, which it might be expected would be found by active survey were they present, were captured by the Malaise trap but not by active recording. There is no obvious reason why this situation should arise. It may be that the relative numbers of different species of *Edwardsiana* change dramatically from year to year and generation to generation, and that during active survey in 1997 small numbers of other species were overlooked amongst much more abundant *E. lethierryi*, but the failure of *E. lethierryi* to appear in the Malaise trap is, in that case, less easily explained.

Edwardsiana plebeja (Edwards, 1914)
A common tree-feeding species, recorded hosts including oak, elm, alder and birch. Captured by the Malaise trap in 1996, it is probably established in the Garden, but its abundance and hosts are uncertain.

Edwardsiana rosae (Linnaeus, 1758)
This is a common species, feeding exclusively on species of rose. It was captured by active survey in the Garden in 1997.

Empoasca decipiens Paoli, 1930
This is a very common species found on a wide range of herbaceous vegetation, including arable crops and garden plants. It was found to be fairly common throughout the Garden during active survey in 1997, and was also caught by the Malaise trap in 1995 and 1996.

(*Empoasca pteridis* (Dahlbom, 1850)
A visit was made to the Garden by Dr B. N. K. Davis in August 1982 for the specific purpose of searching for *E. pteridis*, which at that time was known only from the Chelsea Physic Garden. His success in finding the species was reported *in litt.* to the then head gardener, Mr. D. Mitchell. *Empoasca pteridis* is superficially indistinguishable from the extremely common *E. decipiens*, and fine dissection of the males is needed for determination. Though there are still few records of this species from Britain, they are rather widely scattered. It seems likely that *E. pteridis* has a fairly wide distribution, at least in southern and eastern England, but that it is under-recorded because of being so difficult to distinguish from *E. decipiens* which, as well as being extremely common, is likely to occur in the same places. Though a substantial number of *Empoasca* were taken from the Garden during active survey, and more specimens were available from the Malaise trap, all the males of this species-pair examined proved to be *E. decipiens*. It is, however, entirely possible, and perhaps likely, that *E. pteridis* remains established.

Empoasca vitis (Göthe, 1875)
A common species on woody vegetation, especially where it occurs in mosaic with lower herbaceous vegetation or grassland. It was captured by active survey in 1997, and proved fairly frequent on shrubs throughout the Garden. It was also caught by the Malaise trap in 1996 and 1997.

(*Eupteryx atropunctata* (Goeze, 1778))
A somewhat local species of tall herbaceous vegetation, swept from hawthorn during the earlier survey. It could still occur in the Garden, but lack of knowledge of its host plants make it difficult to know the likelihood of this.

Eupteryx aurata (Linnaeus, 1758)
A very common species, associated with tall herbaceous vegetation, especially tall ruderal vegetation but also including herbaceous plants in gardens. It was found to be fairly common and widespread throughout the Garden during active survey in 1997, and was caught by the Malaise trap in 1995 and 1997.

Eupteryx florida Ribaut, 1936
A common species associated with a wide range of labiate plants, often frequent in gardens. It was common in herbaceous beds during active survey in 1997, and was also caught by the Malaise trap in 1995 and 1996, and by light trapping in 1995.

Eupteryx melissae Curtis, 1837
This is a common species associated with a wide range of labiates, and often frequent in gardens. It was captured in herbaceous borders by active survey in 1997, and by the Malaise trap in 1996 and 1997.

Eupteryx urticae (Fabricius, 1803)
This is a common species, but specific to nettle *Urtica dioica*, not a plant usually encouraged in gardens generally and certainly infrequent in Buckingham Palace Garden. It was captured by the Malaise trap in 1995, and is probably established in the Garden on nettle, even if uncommon.

Eurhadina pulchella (Fallén, 1806)
This is a common oak-feeding species, captured by active survey in the garden in 1997.

Euscelis incisus (Kirschbaum, 1858)
This is a very common grass-feeding species, in southern England absent only from the shortest, the wettest and the most shaded grassland. It was captured by active survey in the Garden in 1997, and was common in areas of taller grassland.

* *Fagocyba cruenta* (Herrich-Schäffer, 1838)
This is a common species associated with a wide range of tree species, especially beech. It was captured by active survey in the Garden in 1997, and was swept in small numbers from woody vegetation.

* *Graphocephala fennahi* Young, 1977
A widespread and often common species on *Rhododendron* in southern England. It was found commonly during active survey of the Garden in 1997, and was also recorded by A. Halstead in 1998, and caught by light trapping in 1995.

Hauptidia maroccana (Melichar, 1907)
An introduced species, established outdoors in the south-west, but elsewhere in Britain confined to glasshouses. It was recorded from the Garden by A. Halstead on glasshouse plants in 1998.

Iassus lanio (Linnaeus, 1761)
A common oak-feeding species: captured by the Malaise trap in 1995 and 1997 and by light-trapping in 1995, and probably well-established in the Garden.

Iassus scutellaris (Fieber, 1868)
A Nationally Scarce species, confined to elm, and of strongly south-eastern distribution. A total of seven individuals were captured by the Malaise trap in 1996, six in the period 11.vii – 1.viii, and a further one in the period 10 – 28.xi: it is almost certainly established in the Garden on elm.

Idiocerus confusus Flor, 1861
This is a generally common willow-feeding species, found fairly commonly on willows in the Garden during active survey in 1997.

Idiocerus distinguendus Kirschbaum, 1868
A common poplar-feeding species: though captured during the recent survey only once, by the Malaise trap in 1996, it is probably established in the garden.

(*Idiocerus nitidissimus* (Herrich-Schäffer, 1835)
A common species on poplars, recorded from its usual host by the earlier survey, and quite likely still to be present in the Garden.

Idiocerus herrichi Kirschbaum, 1868
This is a somewhat local species, feeding on willows, especially white willow. It is a south-eastern species, and has been increasing in frequency and range in southern England for some time. It was captured from crack willow by active survey in the Garden in 1997 and was also caught by the Malaise trap in 1995.

Idiocerus populi (Linnaeus, 1761)
A common poplar-specific species, found to be fairly frequent in the Garden during active survey in 1997.

Idiocerus similis Kirschbaum, 1868
A generally common willow-feeding species, captured by active survey of the Garden in 1997, but found only in small numbers.

Idiocerus stigmaticalis Lewis, 1834
A generally common willow-feeding species, found commonly on willows in the Garden by active survey in 1997.

Idiocerus ustulatus (Mulsant & Rey, 1855)
A recent colonist in Britain, feeding on grey and white poplars, and increasing in the south-east. It was captured only once during the survey, by the Malaise trap in 1996, but is quite likely to be established in the Garden.

Idiocerus vitreus (Fabricius, 1803)
A common poplar-feeding leaf-hopper, found fairly commonly by beating lower branches and searching trunks of poplars in the Garden in 1997.

Jassargus distinguendus (Flor, 1861)
A common grassland leaf-hopper, captured by the Malaise trap in 1997 and probably established in the Garden in areas of taller grassland.

Kybos betulicola (Wagner, 1755)
A common leafhopper on birch, found in moderate numbers in the Garden in 1997 by beating the host plant.

(*Kybos populi* (Edwards, 1908))
A fairly common species on poplars, especially grey and white poplars: recorded 'on poplar' by the earlier survey, and quite likely still to be present in the Garden.

Kybos virgator (Ribaut, 1933)
A common willow-feeding species: captured in the Garden by active survey in 1997.

Linnavuoriana decempunctata (Fallén, 1806)
A somewhat local birch-feeder: captured in the Garden by the Malaise trap in 1997, and probably an established species.

Macropsis graminea (Fabricius, 1798)
A somewhat local species, feeding on several types of poplars: recorded from the Garden by the Malaise trap in 1995, and probably an established species.

Macropsis infuscata (J. Sahlberg, 1871)
A somewhat local species which feeds on willows, especially low-growing forms and species: captured by the Malaise trap in 1995 and probably established in the Garden.

Macropsis mendax (Fieber, 1868)
A Nationally Scarce elm-feeding species, confined to south-eastern counties but able to thrive on low re-growth after Dutch elm disease. It was recorded in the Garden by active survey in 1997, when a single individual was beaten from elm.

Macropsis prasina (Boheman, 1852)
A common willow-feeding species, captured in the garden by active survey in 1997, when it was found in moderate numbers on willows near The Lake margin.

Macrosteles laevis (Ribaut, 1927)
A common and characteristic species of managed grassland, captured amongst both tall and, in smaller numbers, mown vegetation in the Garden by active survey in 1997.

Macrosteles viridigriseus (Edwards, 1924)
A common wetland species, often found amongst low vegetation, including rushes, in marshes and at water margins. It was found quite commonly by sweep-netting at the margin of The Lake in 1997.

Mocydia crocea (Herrich-Schäffer, 1836)
A very common species of dry grassland, found in abundance by sweeping areas of taller grassland in 1997, and also captured by the Malaise trap in 1995, 1996 and 1997.

* *Placotettix taeniatifrons* (Kirschbaum, 1868)
An introduced species which feeds on rhododendron. First recorded in Britain in 1951, it has since been recorded from a number of localities in the south-east, but has remained decidedly local and scarce, in contrast to the other rhododendron-feeding leafhopper, *Graphocephala fennahi*. It is, however, a common species in the Garden, readily captured by sweeping and beating rhododendron during active survey in 1997, and also captured by the Malaise trap in 1995, 1996 and 1997.

Psammotettix confinis (Dahlbom, 1850)
A very common dry grassland species, especially characteristic of short swards: found abundantly by sweeping mown grassland in the Garden in 1997, and in smaller numbers in taller grassland.

Ribautiana cruciata (Ribaut, 1931)
A common species, usually associated with bramble but perhaps sometimes feeding on other members of the Rosaceae. It was captured by the Malaise trap in the Garden in 1995 and 1996.

Ribautiana debilis (Douglas, 1876)
A common species, usually feeding on bramble but recorded from other shrubby plants: recorded by active survey in the garden in 1997, when a few were swept from low woody vegetation.

Ribautiana tenerrima (Herrich-Schäffer, 1834)
A chiefly bramble-associated species, probably the commonest of the genus in southern England. It was captured by the Malaise trap in 1995 and 1996.

* *Ribautiana ulmi* (Linnaeus, 1758)
A somewhat local species which feeds on elm, including wych elm and young re-growth after Dutch elm disease. It was captured by the Malaise trap in 1995, 1996 and 1997, by light-trapping in 1995, and is probably well-established in the Garden. It is surprising that this species was not recorded by active survey in 1997.

Thamnotettix dilutior (Kirschbaum, 1868)
A common species, the adults of which live on trees and shrubs, especially at habitat transitions or mosaics, such as woodland margins and rides. It was captured in the Garden by the Malaise trap in 1995, 1996 and 1997, and by light-trapping in 1995, and is probably well-established in areas where trees grow amongst taller grassland.

Zygina angusta Lethierry, 1874
A common species found on a wide range of trees and shrubs, found in small numbers over a wide area of the garden by active survey in 1997, and captured by the Malaise trap in 1996.

Zygina flammigera (Geoffroy in Fourcroy, 1785)
A common species associated with a wide range of trees and shrub, found fairly commonly throughout the Garden during active survey in 1997, and captured by the Malaise trap in 1996 and 1997.

Zyginidia scutellaris (Herrich-Schäffer, 1838)

A very common grassland species, found in all but very short, very wet and very shaded grassland. It was captured commonly in the Garden by sweep-netting tall grassland during active survey in 1997.

DELPHACIDAE

Asiraca clavicornis (Fabricius, 1794)

This is a Nationally Scarce species, largely restricted in Britain to a small area in the south-east, and most frequent in the London area, where it can occur commonly on derelict land. It is typically found in dry, well-drained tussocky grassland. Three individuals were captured by the Malaise trap in 1995, one in the period 7–22.ix and two in the period 22.ix–20.x. It seems likely that this species is established in the Garden, but it may be restricted to the least-managed areas of unshaded grassland.

Dicranotropis hamata (Boheman, 1847)

A common and characteristic dry grassland species, captured commonly by sweep-netting in areas of taller grass in the Garden during active survey in 1997.

Javesella dubia (Kirschbaum, 1868)

A common grass-feeding species, usually found in somewhat damp or shaded situations. It was captured by the Malaise trap in 1996. Though it is quite likely to be established in the Garden, it may well be rather localised.

Javesella pellucida (Fabricius, 1794)

A common grass-feeding species, characteristic of dry grassland but also found in other reasonably dry and unshaded habitats where grasses may form only a minor component of the vegetation. It was found in moderate numbers in taller grassland in the Garden by sweep-netting in 1997.

Stenocranus minutus (Fabricius, 1787)

A common plant hopper amongst tall dry grassland, usually associated with cock's-foot *Dactylis glomerata*. It was captured by the Malaise trap in 1995 and, though probably established in the Garden, may be confined to the least managed areas of grassland.

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The psyllids, whiteflies, scales and mealybugs (Hemiptera: Homoptera) of Buckingham Palace Garden

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Abstract

Four visits to The Garden and glasshouse at Buckingham Palace in 1997 and 1998 produced a species list of 13 scale insects, including one new record for Britain, five mealybugs, three psyllids and three whiteflies. The results are compared with an earlier survey conducted in the early 1960s.

Introduction

Psyllids or suckers, whiteflies, mealybugs and scale insects are all sap-feeding insects in the Hemiptera: Homoptera. Some are pests of economic importance because of the feeding damage which can include soiling the foliage with their sticky excrement, known as honeydew (Alford, 1984 & 1991). Sooty moulds often grow on the honeydew and further disfigure the plants.

Methods

The Palace Garden and glasshouse was surveyed on 13 August and 9 September 1997 by the author. Scale insects and mealybugs are relatively immobile insects and they were searched for by examining the foliage and bark of likely host plants. Additional collections were made by Vic Eastop on 24 April 1997 and 9 June 1998 whilst he was searching for aphids. Similar methods were used to record psyllids and whiteflies on the foliage of host plants. Some psyllids were taken in the Malaise trap on The Mound, but most of these remain unidentified due to the lack of a specialist willing to name them. Those that have been recorded in the current survey are those that can be named with confidence through their association with host plants and the distinctive damage they cause. Scales and mealybugs were passed to Dr C. Malumphy of the Central Science Laboratory, York, for confirmation of their identity.

Results and discussion

The whiteflies and psyllids recorded in the earlier survey of Buckingham Palace Garden were collected and identified by V. F. Eastop (1964). The list of psyllids published in 1964 contained seven species, two of which were recorded again in the present survey. The other five species are common, widespread psyllids and, since their food plants still grow in the Palace Garden, they are likely still to occur there. Three additional species, *Floria variegata, Trioza alacris* and *Ctenarytaina eucalypti* have been added to the list in 1997. Three whitefly species were found in the current survey, giving a combined list total of four species.

In the earlier survey scale insects and mealybugs were mostly collected and identified by K. Boratynski in October 1963, with one species added in May 1964. Two other species, *Aspidiotus hederae* and *Coccus hesperidum*, were recorded by V. F. Eastop and identified by D. J. Williams (Boratynski & Eastop, 1964). Nine scale insects and one mealybug were recorded in total. The 1997 survey confirmed the presence of five of these scales and added eight further species. One of these was *Hemiberlesia rapax*, sometimes known as the greedy scale. It had previously been intercepted on imported plant material, but this was the first record of its occurrence in Britain. It was on a container-grown plant of *Myoporum leatum* growing in the Nursery Yard glasshouse. The plant had been obtained from a nursery near Redruth, Cornwall, in 1996. Three additional species of mealybugs were recorded, although two of these are tentative identifications because of difficulties with the material collected.

An annotated list of psyllids, whiteflies, scales and mealybugs recorded in Buckingham Palace Garden

The checklists used are Kloet & Hincks (1964) for the whiteflies (Aleyrodidae) and Hodkinson & White (1979) for the suckers (Psylloidea). The soft scales (Coccidae) are named according to Ben-Dov (1993); the other scales (Diaspididae, Asterolecaniidae and Eriococcidae) and mealybugs (Pseudococcidae) follow Kloet & Hincks (1964) with some updated names suggested by C. Malumphy. Where the names differ from those in Kloet & Hincks, the old names are indicated in square brackets after the current name. Species found in the earlier survey, but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey.

HEMIPTERA: HOMOPTERA

PSYLLOIDEA

APHALARIDAE

(*Strophingia ericae* (Curtis, 1835))
On heather, *Calluna vulgaris*.

PSYLLIDAE

Floria variegata Löw, 1882
On *Laburnum anagyroides*, collected by V. F. Eastop on 22.iv.1997, and identified by D. Hollis.

(*Psyllopsis fraxini* (L., 1758))
On ash, *Fraxinus* sp.

(*P. fraxinicola* (Förster, 1848))
On ash, *Fraxinus* sp.

* *Psylla buxi* (L., 1758) The Box Sucker.
Causes distinctive cupped leaves at the shoot tips on box, *Buxus sempervirens*. Widespread in the Palace Garden.

P. mali Schmidberger, 1836
Nymphs on apple, *Malus* sp., 22.iv.1997 (V. F. Eastop).

(*P. melanoneura* Förster, 1846)
On hawthorn, *Crataegus* sp.

(*P. peregrina* Förster, 1848)
On hawthorn, *Crataegus* sp.

TRIOZIDAE

Trioza alacris Flor, 1861 The Bay Sucker
Causes distinctive yellow thickening and leaf curling of leaf margins on bay, *Laurus nobilis*. Present in Britain since at least the 1930s, but not recorded in the previous survey (nor was the host plant). Found on bay trees near the Nursery Yard.

Trioza urticae (L., 1758)
On nettles, *Urticae dioica*, on 9.vi.1998, and in the Malaise trap samples for 20.xi–20.xii.1995 and 20.xii.1995–23.ii.1996.

SPONDYLIASPIDAE

Ctenarytaina eucalypti (Maskell, 1895) The Eucalyptus Sucker.
On *Eucalyptus* sp. in the Silver Garden. An Australian insect that reached Britain in the early 1920s. Not found in the earlier survey due to a possible absence of host plants.

ALEYRODOIDEA

ALEYRODIDAE

* *Siphoninus phillyreae* (Haliday, 1834)
On hawthorn, *Crataegus oxyacanthoides*, in the earlier survey. On 9.ix.1997 a small patch of adults and nymphs was found on an ash leaf, *Fraxinus excelsior*, near the Grosvenor Place wall.

Trialeurodes vaporariorum (Westwood, 1856) The Glasshouse Whitefly.
Adults and nymphs, some parasitised by the chalcid wasp *Encarsia formosa*, on many plants in the Nursery Yard glasshouse. Surprisingly not on the 1964 list as this whitefly is a pest in nearly every glasshouse in the land.

* *Aleurotuba jelinekii* (von Frauenfeld, 1867) [= *Aleurotrachelus jelinekii*] The Viburnum Whitefly.
Pupal stage found on *Viburnum tinus*.

(*Aleyrodes lonicerae* Walker, 1852)
On *Glechoma hederacea*.

COCCOIDEA

DIASPIDIDAE

(*Aspidiotus hederae* (Vallot, 1829))
On glasshouse palms. The glasshouses at the Palace are much less extensive than in the 1960s and this may explain the absence of this widespread glasshouse scale, which has a wide range of host plants.

Hemiberlesia rapax (Comstock, 1881)
On *Myoporum leatum* foliage in the glasshouse. New to Britain — see comments in the 'Results and discussion' section.

Carulaspis carueli (Signoret, 1869)
On juniper foliage, *Juniperus* sp. in square J4 [see map on pages 2–3].

* *Chionaspis salicis* (L., 1758)
On the bark of ash, *Fraxinus excelsior*, and willow, *Salix* sp. In the earlier survey it was also recorded on lime, *Tilia* sp.

* *Lepidosaphes ulmi* (L., 1758) The Mussel Scale.
Described as numerous on the bark of crab and fruiting apples, *Malus* spp., hawthorn, *Crataegus monogyna*, and dogwood, *Cornus alba*, in the earlier survey. It had become very scarce in 1997 and required much searching to find a few scales on *Crataegus monogyna*. It is a common pest and its decline is likely to be a temporary one, perhaps brought about by parasitic wasps, which sometimes devastate scale infestations.

ASTEROLECANIIDAE

Asterodiaspis minus (Lindinger, 1912))
On the bark of young oak twigs, *Quercus robur*, 1.v.1964.

* *A. quercicola* (Bouché, 1851).
On *Quercus robur* as above and found again on oak saplings on The Mound on 13.viii.1997.

COCCIDAE

Pulvinaria floccifera (Westwood, 1870) [= *Chloropulvinaria floccifera*] The Camellia Cushion Scale.
Egg sacs and nymphs common on *Camellia japonica*, holly, *Ilex aquifolium* and *Gleditsia aquatica*. The last mentioned is an unusual host plant as it is a deciduous tree and this scale is usually found on various evergreen trees and shrubs.

P. regalis Canard, 1968 The Horse Chestnut Scale.
Now common in southern England, this was an undescribed species new to Britain in 1964 when it was found near Kew Gardens. It probably originated from Japan. Egg sacs and nymphs found on *Acer* spp., including *A. rubra*, 9.vi.1998 (V. F. Eastop), *Aesculus hippocastanea*, *Cornus* sp., *Ptelea trifoliata* and *Tilia* sp.

P. vitis (L., 1758) The Woolly Vine Scale.
A polyphagous scale found as a single egg mass and dead female on a large willow, *Salix* sp., near The Lake.

* *Coccus hesperidum* L., 1758 Soft Scale.
On holly, *Ilex aquifolium* in the earlier survey. On *Myoporum leatum* and *Citrus* plants in the glasshouse on 13.viii.1997. A common pest, mostly on indoor plants.

(*Eulecanium tiliae* (L., 1758))

On hawthorn, *Crataegus monogyna*, found as a single, dead, parasitised female. A widespread species not found in the current survey but easily overlooked as it is often present on its various host plants in low numbers.

Parthenolecanium corni (Bouché, 1844) Brown Scale.

A common pest of many deciduous trees and shrubs. On jasmine, *Jasminum officinale*, on the Royal Mews wall and on ash, *Fraxinus excelsior*, near the Grosvenor Place wall on 9.ix.1997.

P. rufulum (Cockerell, 1903)

An infrequently recorded scale. Heavy infestations were found on some of the oaks, *Quercus robur* and *Q. nigra* on The Mound. It was also on *Gleditisia caspica* in the same locality. This is an unusual host plant for this scale, which is mostly on oak, but a wide range of trees and shrubs is recorded in Ben-Dov (1993).

Saissetia oleae (Olivier, 1791) Black Hemispherical Scale.

In the glasshouse on *Myoporum leatum*. This scale is restricted to heated glasshouses in Britain.

ERIOCOCCIDAE

* *Cryptococcus fagisuga* Lindinger, 1936 [= *C. fagi*] The Felted Beech Coccus.

On the bark of beech, *Fagus sylvatica*. Described as fairly numerous in 1964, but not found in any quantity in 1997. It is a common scale on beech, but favours trees which have relatively thin bark.

(*Pseudochermes fraxini* (Kaltenbach, 1860))

Recorded as numerous and well established on most ash trees, *Fraxinus* sp., in the Palace Garden in the earlier survey, but not found in 1997.

PSEUDOCOCCIDAE

(*Phenococcus aceris* (Signoret, 1875)

Occurs on a wide range of trees and shrubs. Recorded in the earlier survey as a single nymph on Turkey oak, *Quercus cerris*.

Pseudococcus calceolariae (Maskell, 1879) [= *P. fragilis* Brain]

Tentatively identified by C. Malumphy from a small cluster on *Viburnum tinus* growing on The Mound, 13.viii.1997.

P. longispinus (Targioni-Tozzetti, 1867) [= *P. adonicum* L.]

On various plants in the glasshouse. A common pest of many indoor plants.

P. viburni (Signoret, 1875) [= *P. obscurus* Essig]

A common glasshouse mealybug. Tentatively identified by C. Malumphy from specimens collected from *Myoporum leatum* in the glasshouse.

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The aphids (Hemiptera: Homoptera) of Buckingham Palace Garden

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Abstract

Visits to Buckingham Palace Garden on 22 April 1997 and 9 June 1998 yielded 27 aphid taxa, including seventeen that were not recorded in an earlier survey, carried out in the early 1960s. A further three species not found on their host plants were taken in a Malaise trap, bringing the total number of aphids known from the Garden to 82, about 13% of the known British fauna. No Adelgidae or Phylloxeridae were recorded.

Introduction

Aphids (Aphidoidea: Adelgidae, Phylloxeridae and Aphididae) are well known pests of agriculture and horticulture, both because of their feeding damage due to removal of sap and in some cases toxic saliva, but more particularly because of their virus transmitting ability. Most of the major crops of temperate agriculture suffer from aphid-transmitted viruses. More than two hundred plant viruses are known to be transmitted by more than two hundred species of aphids. Only a small proportion of the world's 250,000 vascular plants have had their viruses investigated and only about 5% of the world's 5,000 known species of aphids have been tested as vectors of any virus. Because of their abundance, aphids are the food of many other organisms, including birds, ladybird beetles (Coccinellidae), hoverfly larvae (Syrphidae) etc, and are parasitised by many small wasps and some flies. These parasitoids are in turn parasitised by other small wasps (hyperparasites) and in some cases tertiary parasites are known. The great majority of these food webs remain to be investigated. In many cases, the parasitoids of aphid predators belong to the same genus as the aphid parasitoids. Again the ecological and evolutionary implications have been little investigated.

Aphids differ from many other groups in having most species in the northern temperate region and fewer species in the tropics and in the southern hemisphere. However, there are a number of small groups known mostly from the tropics and the southern hemisphere, which may be relics of different situations in the past. Greenfly are often thought of as pests of herbaceous plants and the young growth of shrubs, but this is due to the preponderance of one subfamily, the Aphidinae, in the northern hemisphere. Most subfamilies of aphids are associated with trees and the group probably evolved before the evolution of herbaceous flowering plants, which only a few subfamilies of aphids managed to colonise.

Methods

The Garden was visited on 22 April 1997 and 9 June 1998, when aphids were observed on their host plants and samples of uncertain identity were collected for more detailed study. Catches from a Malaise traps operated from 1995 to 1997 were sorted by Colin Plant and also made available.

Results and Discussion

Eastop (1964) reported 60 aphid taxa encountered during a survey carried out in the early 1960s. Fourteen of the aphids recorded in that work were seen again during the current project and an additional seventeen species were also found; two other species collected in the earlier survey have been identified. The Malaise trap caught specimens of some of the species found on their host plants and also three additional species. The overall total of 82 aphid species from the Garden is about 13% of the known British aphid fauna. The small proportion of the fauna found probably reflects the absence of habitats particularly favoured by aphids, such as well-drained sunny banks with a diverse flora and population of ants. Many aphids feed on roots, but as there are limitations in digging up plants in other people's gardens these habitats were not examined in as much detail as more aerial ones.

An annotated list of aphids recorded in Buckingham Palace Garden

Nomenclature follows Remaudière & Remaudière (1997). Species found in the earlier survey, but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey.

HOMOPTERA

APHIDOIDEA

APHIDIDAE

ERIOSOMATINAE (PEMPHIGINAE of the earlier account)

* *Eriosoma patchiae* (Börner & Blunmck, 1916)/*ulmoscedens* Marchal, 1919
In distorted leaves of *Ulmus campestris* in early summer and winged sexupara of *E. umoscedens* Marchal in the Malaise trap, 17–24.viii.1995. *E. patchiae* migrates to the roots of *Senecio*, including *S. cineraria*, in early summer and returns to elm in late September or October. The wingless spring forms of *patchiae* and *ulmosedens* are not separable and they may not really be different species.

(*Tetraneura ulmi* (L., 1758))
From roots of *Poa annua*. The overwintering egg is laid on elm and galls are produced on the upper surface of leaves in May and June These open to release winged forms, which fly to grasses.

Patchiella reaumuri (Kaltenbach, 1843)
Malaise trap, 11.vii.–1.viii.1996. This aphid overwinters on linden, *Tilia* spp., where in the spring it makes 'leaf nests' on young growth, particularly suckers from the base of the trunk, and then spends the summer on the roots of *Arum*.

(*Pemphigus bursarius* (L., 1758))
Gall on the leaf petiole of *Populus nigra*. Summer is spent on the roots of lettuce and sowthistle.

(*Pemphigus* sp.)
From roots of *Hydrocotyle vulgaris*, not certainly distinct from *P. bursarius*.

Aploneura lentisci (Passerini, 1856)
Malaise trap, 20–28.vii.1995. Normal hosts in England are grass roots, and it is common in wax wool on the roots on *Poa annua*. Primary hosts in the Mediterranean region *Pistacia* species as in other Fordini.

(*Forda formicaria* von Heyden, 1837)
From *Poa annua* roots.

PHLOEOMYZINAE

(*Phloeomyzus passerinii* Signoret, 1825)
In wax wool on the bark of *Populus nigra*.

ANOECIINAE

Anoecia sp.
Malaise trap, 7–22.ix.1995 and 11.vii.–1.viii.1996. Vagrant alata 9.vi.1998. Most *Anoecia* overwinter on *Cornus* and spend the summer on grass roots.

DREPANOSIPHINAE

* *Drepanosiphum platanoidis* (Schrank, 1801)
Under leaves of *Acer pseudoplatanus.*

PHYLLAPHIDINAE

Phyllaphis fagi (L., 1767)
On Fagus, 9.vi.1998. In the 1960s survey it was found in waxwool under leaves of *Fagus silvatica*, including varieties *purpurea* and dawyck.

CALAPHIDINAE (= DREPANOSIPHINAE in part, in the previous account).

* *Euceraphis betulae* (Koch, 1855) (= *punctipennis* of the previous account)
9.vi.1998. In the earlier survey it was found under leaves of *Betula* sp.

(*Betulaphis quadrituberculata* (Kaltenbach, 1843))
On leaves of *Betula allegeniensis.*

* *Myzocallis boerneri* Stroyan, 1957
9.vi.1998 on *Quercus cerris.* In the earlier survey it was found under leaves of *Q. ilex.*

* *Myzocallis coryli* (Goeze, 1778)
9.vi.1998. In the earlier survey it was found under leaves of *Corylus* sp.

(*Pterocallis alni* (De Geer, 1773))
Under leaves of *Alnus* sp.

* *Eucallipterus tiliae* (L., 1758)
9.vi.1998. In the earlier survey it was found under leaves of *Tilia* sp.

SALTUSAPHIDINAE

(*Subsaltusaphis* sp. ? *ornata* (Theobald, 1927))
Vagrant, probably from *Carex.*

CHAITOPHORINAE

(*Chaitophorus capreae* (Mosley, 1841))
On leaves of *Salix caprea.*

Chaitophorus leucomelas Koch, 1854
22.iv.1997, on leaves of *Populus ?nigra.*

(*Chaitophorus niger* Mordwilko, 1929)
Feeding on the outside of *Pontania* galls on *Salix* x *blanda* and on leaves of *S.* x *sepulchralis.*

(*Chaitophorus populialbae* (Boyer de Fonscolombe, 1841) (= *albus* Mordwilko, 1901))
Under leaves of *Populus alba.*

Periphyllus californiensis (Shinji, 1917)
On young shoots and under leaves of *Acer palmatum* var. *heptalobum* on 22.iv.1997, and aestivating as first instar larvae.

(*Periphyllus testudinacea* (Fernie, 1852) (= *testudinatus* Thornton, 1852))
Under leaves of *Acer rubrum* in spring and aestivating as first instar larvae.

(*Sipha glycerinae* (Kaltenbach, 1843))
On grasses near The Lake.

PTEROCOMMATINAE

Pterocomma sp.,
22.iv.1997. Vagrant alata *Pterocomma* spp. live on the twigs of poplars and willows.

APHIDINAE

(*Aphis cytisorum* Hartig, 1841)
On *Laburnum.*

* *Aphis fabae* Scopoli, 1763
On *Euonymus americanus* and on *Viburnum*, 22.iv.1997 and on *Chrysanthemum* and *Heracleum mantegazzianum* and *Malus toringiodes*, 9.vi.1998. In the earlier survey on *Philadelphus*, *Rumex*, *Lythrum salicaria* and *Chaenomeles.*

(*Aphis grossulariae* Kaltenbach, 1843)
On *Ribes uva-crispa*, spends the summer on *Epilobium*.

(*Aphis ilicis* Kaltenbach, 1843)
On *Ilex aquifolium*.

Aphis nasturtii Kaltenbach, 1843
9.vi.1998, on *Lythrum salicaria*. Some populations, at least, overwinter on *Rhamnus*.

* *Aphis pomi* De Geer, 1773
9.vi.1998, on *Malus toringoides*, *Sorbus umbellata* and *Pyrus communis*. In the earlier survey found on *Malus* sp. and *Pyrus communis*.

(*Aphis salicariae* Koch, 1855 (= *corniella* Hill Ris Lambers, 1935))
On *Cornus* spp. in spring and autumn, and on *Epilobium adenocaulon* in the summer.

Aphis sp.
On *Hypericum* sp.

(*Rhopalosiphum insertum* (Walker, 1849))
On Crataegus, *Malus floribunda*, *Malus* sp. Live at soil level on grasses in summer.

(*Rhopalosiphum padi* (L., 1758))
On *Dactylis glomerata* and undetermined grasses. Some populations overwinter on *Prunus padus*.

(*Schizaphis palustris* (Theobald, 1929))
On *Poa annua*.

(*Dysaphis devecta* (Walker, 1849))
In red leaf-edge galls on *Malus floribunda*.

Dysaphis radicola (Mordwilko, 1897)
22.iv.1997, on base of stem of *Rumex ?obtusifolius*.

Ceruraphis eriophori (Walker, 1848)
Large colonies on *Viburnum carlsii*; small colonies on *V. burckwoodii* on 22.iv.1997. Spends the summer on *Carex*, *Eriophorum* or *Luzula*.

* *Brachycaudus helichrysi* (Kaltenbach, 1843)
On *Prunus cerasifera* 'Pissardii' on 22.iv.1997 and on many other plants, particularly Compositae, including *Achillea millefolium* and *Chrysanthemum* in the Garden.

(*Nasonovia ribisnigri* (Mosely, 1841))
On lettuce, overwinters on *Ribes*.

* *Liosomaphis berberidis* (Kaltenbach, 1843)
22.iv.1997, on *Mahonia*, and parasitised by *Aphidius hortensis* Marshall (Braconidae). In the earlier survey found on *Berberis*.

Longicaudus trirhodus (Walker, 1849)
On *Rosa* cultivar, 22.iv.1997. It spends the summer on *Aquilegia*.

(*Rhopalomyzus poae* (Gillette, 1908))
On grasses; overwinters on *Lonicera alpigena*.

(*Brevicoryne brassicae* (L., 1758))
The mealy cabbage aphid, in the Malaise trap sample for 31.viii.7.ix.1995.

(*Cavariella aegopodii* (Scopoli, 1763))
On *Salix* sp. in the spring, spending the summer on many Umbelliferae.

Cavariella pastinacae (L., 1758)
In the Malaise trap sample for 20–28.vii.1955; alternates between *Salix* and *Heracleum*, more rarely *Pastinaca*.

(*Cavariella theobaldi* (Gillette & Bragg, 1918))
On *Salix* and an undetermined umbelliferous plant, perhaps *Angelica*. Commonly found on *Heracleum* and *Pastinaca* and more rarely other Umbelliferae.

(*Myzaphis rosarum* (Kaltenbach, 1843))
On *Rosa*.

(*Chaetosiphon tetrarhodum* (Walker, 1849))
On *Rosa*.

(*Capitophorus horni* ssp *gynoxantha* Hill Ris Lambers, 1953)
On *Cirsium arvense*.

(*Myzus ascalonicus* Doncaster, 1946)
Flying. An almost polyphagous aphid.

(*Myzus cerasi* (F., 1775))
On *Prunus avium*; goes to *Galium* and some *Cruciferae* in early summer.

(*Myzus cymbalariae* Stroyan, 1954)
On lettuce.

(*Myzus ligustri* (Mosley, 1841))
On *Ligustrum ovalifolium*.

Myzus lythri (Schrank, 1801)
On *Lythrum salicaria*, 22.iv.1997; overwinters on *Prunus mahaleb*.

Myzus ornatus Laing, 1932
On *Abelia* sp. (parasitised by an *Aphidius* (Braconidae), 22.iv.1997), and on *Veronica hebe*.

(*Myzus persicae* (Sulzer, 1776))
On *Antirrhinum*, *Chrysanthemum*, *Dianthus*, lettuce, *Salvia*, *Zinnia*. Some populations overwinter on peach.

Myzus varians Davidson, 1912
9.vi.1998, on *Clematis montana* var *grandiflora*. Overwinters on peach.

Phorodon humuli (Schrank, 1801)
22.iv.1997, on *Prunus cerasifera* 'Pissardii'; spends the summer on hops.

(*Ovatus* sp.)
On *Crataegus* sp.. *Ovatus* spp. spend the summer on Labiatae including mint.

(*Megoura viciae* Buckton, 1876)
On *Lathyrus pratensis*.

Wahlgreniella nervata (Gillette, 1908)
22.iv.1997, On *Arbutus* x *andrachnoides*.

(*Amphorophora rubi* (Kaltenbach, 1843))
On cultivated *Rubus*.

Microlophium carnosum (Buckton, 1876)
22.iv.1997, on *Urtica dioica*, on which there were also adult *Coccinella 7-punctata*.

(*Acyrthosiphon pisum* (Harris, 1776))
On *Lathryus pratensis*.

(*Hyalopteroides humilis* (Walker, 1852))
On *Dactylis glomerata*.

(*Metopolophium albidum* Hille Ris Lambers, 1947)
In flight. The host plant is *Arrhenatherum*.

(*Metropolophium dirhodum* (Walker, 1849))
On *Rosa*, the primary host, and undetermined grasses (summer hosts).

(*Metopolophium festucae* (Theobald, 1917))
On *Festuca rubra*.

(*Sitobion avenae* (F., 1775))
On *Dactylis glomerata*.

(*Sitobion fragariae* (Walker, 1848))
On *Festuca rubra*. Overwintes on brambles.

* *Macrosiphum euphorbiae* (Thomas, 1878)
22.iv.1997 on *Rosa*. In the earlier survey, found on *Rosa carolina*, *Chaenomeles lagenaria*, lettuce, *Phlox*, *Calceolaria* and *Gladiolus*.

Macrosiphum gei (Koch, 1855)
Malaise trap, 24.iv–15.v.1997. Overwinters on *Geum* and spends the summer on *Anthriscus* and related Umbelliferae.

* *Macrosiphum rosae* (L., 1758)
On *Rosa*, 22.iv.1997. In the earlier survey, found on *Ilex aquifolium*. Often in the summer on teasel.

Corylobium avellanae (Schrank, 1801)
On Corylus avellana, 22.iv.1997.

(*Uroleucon cirsii* (L., 1758))
On *Cirsium arvensis.*

(*Macrosiphoniella artemisiae* (Boyer de Fonscolombe, 1841))
On *Artemisia vulgaris.*

(*Macrosiphoniella oblonga* (Mordwilko, 1901))
On *Artemisia vulgaris.*

Lachninae
Maculolachnus submacula (Walker, 1848)
On the ends of shoots of rambler roses growing in shade, 22.iv.1997. Usual habitat is base of the stem or roots of roses.

(*Cinara piceae* (Panzer, 1801))
In the mercury vapour light trap. The host plants are *Picea* spp.

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Lacewings (Neuroptera), snakeflies (Raphidioptera), alderflies (Megaloptera) and scorpion flies (Mecoptera) in Buckingham Palace Garden

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Abstract

Neuroptera were sampled in Buckingham Palace Garden using a single Malaise trap, operated between 20 April 1995 and 18 August 1997 and through regular field survey during the period 1995 to 1997. Twenty-one species were recorded, together with an additional species added during 1998. Five further species recorded in earlier surveys bring the overall total for the Garden to twenty-seven. The species are listed and discussed. No specimens of Raphidioptera, Megaloptera or Mecoptera were recorded during the study.

Introduction

In an earlier survey of Buckingham Palace Garden, carried out in the period from 1961 to 1963 (Richards 1964), rather surprisingly, only three species of lacewing were recorded. There were no records at all of snakeflies (Raphidioptera), alderflies (Megaloptera) or scorpion flies (Mecoptera). A mercury-vapour light trap was operated after termination of that earlier survey, primarily to catch Lepidoptera. Some of the records of lacewings from that trap were subsequently summarised by Kirby (1981), adding a further eight species and bringing the total up to eleven. This paper summarises those published records and reports on additional material obtained through field survey by the author and others during the years 1995 to 1998, from a Malaise trap operated on The Mound from 20 April 1995 to 18 August 1997 and from a mercury-vapour light trap, also positioned on The Mound.

Results

The present survey records twenty-two species of Neuroptera, but there are no examples of Raphidioptera, Megaloptera or Mecoptera. Thirteen of this total have not been recorded before from the Garden; two further species are previously recorded but have not been published. Three taxa (*Chrysopa perla*, *Chrysoperla carnea* agg. and *Wesmaelius subnebulosus*) were recorded during an earlier survey from 1961 to 1963 (Richards 1964) and eleven species were recorded during the 1970s at a mercury-vapour light trap (Kirby 1981). Taken together, these lists combine to produce an overall list of twenty-seven species of Neuroptera for Buckingham Palace Garden of which five have not been recorded for approximately twenty years.

Discussion

There seem to be rather few data on the Neuropterida (Neuroptera, Raphidioptera and Megaloptera) and Mecoptera of the Middlesex vice-county — published or otherwise. The first work of significance to include records from Middlesex was probably the monograph of that group published by The Ray Society (Killington 1936, 1937). A later paper by Pinniger (1946) summarised available knowledge (which was minimal), for five administrative counties affecting the London Area (Middlesex, Kent, Surrey, Hertfordshire and Essex). That work listed nineteen neuropteran species for Middlesex. In a more recent review of the London Area as a whole, Plant (1992*a*) listed 59 species for all time (four Raphidioptera, three Megaloptera, 48 Neuroptera and four Mecoptera), though it was not the intention in that work to produce a list for Middlesex in particular. In a rather more in-depth analysis of records, Plant (1994) produced national distribution maps for all the British Neuropterida and Mecoptera and summarised records of these for the thirteen 'best-recorded' vice-counties. Middlesex ranked tenth, with an all-time list of 41 species, of which 39 were recorded since 1899 and 26 since the end of 1979. An old record of one additional species has been added to the Middlesex total since that work was published, bringing the vice-county list to 42, still with 26 since the end of 1979. The numbers are not directly comparable, since earlier totals did not take account of the recent split in the *Chrysoperla carnea* complex but, nevertheless, the list of eighteen species currently present in Buckingham Palace Garden represents in the order of 70 per cent of the modern total for the vice-county. Species formerly recorded in Buckingham Palace Garden, but apparently no longer present, are shown in Table 1. Species recorded for Middlesex vice-county, but never recorded in Buckingham Palace Garden are presented in Table 2. Since none of the species on the current list for the Garden is particularly unexpected, an examination of the absent species might be rather more illuminating.

TABLE 1. Species of Neuropterida and Mecoptera reported from Buckingham Palace Garden in the past, but for which there are no current records.

Group / species	**Year of last record**
Coniopterygidae	
Semidalis aleyrodiformis (Stephens, 1836)	1974
Hemerobiidae	
Micromus variegatus (Fabricius, 1793)	1979
Hemerobius nitidulus Fabricius, 1777	1979
Chrysopidae	
Chrysopa commata Kis & Ujhelyi, 1965	1976
Chrysopa pallens (Rambur, 1838)	1979

The complete lack of snake flies (Raphidioptera) is not unexpected, since all four British species are, apparently, inhabitants of woodland habitat. *Atlantoraphidia maculicollis* is associated with pines and is most frequently found at the edges of rides in coniferous plantations; it is rather scarce in Middlesex and may even be no longer present. *Phaeostigma notata* seems to have a strict association with oak trees whilst *Xanthostigma xanthostigma* may possibly be similarly associated, though some earlier works (e.g. Fraser 1959) suggest a link with willows.

The absence of alderflies (Megaloptera) is less easily explained, though only *Sialis lutaria* is at all expected here. This species has aquatic larvae that prefer slow or static waters, over a silt substrate. It is a very common insect throughout Middlesex and is noted for its synchronised emergence of adults, usually numbering thousands, along river banks and around lake margins in the spring. Perhaps it is only the lack of submerged and emergent aquatic vegetation in The Lake that prevents this species from colonising?

Sisyra terminalis is another aquatic species and is equally unlikely to occur. Although it is the least often encountered of the British spongeflies, it has been reported from Middlesex in some numbers, but only at a single locality. Peter Barnard noticed the species swarming in large numbers around a bush overhanging the river near the main road bridge at Staines. He caught several specimens on 5 July 1975 (all in BMNH), following a tip-off by Bill Dolling who had caught some specimens at the same spot in June 1973.

TABLE 2. Species of Neuropterida and Mecoptera recorded for Middlesex Vice-county, but never reported from Buckingham Palace Garden.

Group / species	**Period of last record for Middlesex**
Raphidioptera	
Raphidiidae	
Atlantoraphidia maculicollis (Stephens, 1836)	pre-1980
Phaeostigma notata (Fabricius, 1781)	post-1979
Xanthostigma xanthostigma (Schummel, 1832)	post-1979
Megaloptera	
Sialidae	
Sialis lutaria (Linnaeus, 1758)	post-1979
Neuroptera	
Sisyridae	
Sisyra terminalis Curtis, 1854	pre-1980
Coniopterygidae	
Parasemidalis fuscipennis (Reuter, 1894)	post-1979
Hemerobiidae	
Drepanepteryx phalaenoides (Linnaeus, 1758)	post-1979
Micromus angulatus (Stephens, 1836)	pre-1980
Hemerobius pini Stephens, 1836	pre-1980
Hemerobius simulans Walker, 1853	post-1979
Wesmaelius nervosus Fabricius, 1793	post-1979
Wesmaelius concinnus (Stephens, 1836)	pre-1900
Sympherobius pellucidus (Walker, 1853)	post-1979
Chrysopidae	
Dichochrysa ventralis (Curtis, 1834)	pre-1980
Nineta vittata (Wesmael, 1841)	pre-1980
Mecoptera	
Boreidae	
Boreus hyemalis (Linnaeus, 1767)	pre-1980
Panorpidae	
Panorpa communis Linnaeus, 1758	post-1979
Panorpa germanica Linnaeus, 1758	post-1979

The absence from the current survey of rather small species such as the wax-fly *Semidalis aleyrodiformis* is possibly due to these having been overlooked. Similar comments might apply equally to *Parasemidalis fuscipennis,* which has never been recorded in the Garden. However, Neuroptera associated with pines are rather more of a mystery. They are represented on the Garden list by three species — *Conwentzia pineticola, Hemerobius stigma* and *Nothochrysa capitata* — and the absence of some of the other pine-associated species, such as *Hemerobius nitidulus, H. pini* and *Wesmaelius concinnus* is difficult to explain. Killington (1937) asserted that *Sympherobius pellucidus* is also associated with pines, though that assertion is challenged by recent data (Plant, 1994).

Also restricted to coniferous trees, though not pines, is *Hemerobius simulans.* It is confined largely to larch *Larix* spp., but is perhaps also on spruce *Picea* spp. It is not expected in Buckingham Palace Garden.

Micromus angulatus is a very local species that is not at all expected in a built-up, urban area. Likewise, the distinctive *Drepanepteryx phalaenoides,* which is a species of mature woodland containing a high proportion of oak.

The green lacewing *Chrysopa commata* was also recorded once only, also in June 1976 and it is interesting to speculate that this may have been 'called down' by the light trap from the 'aerial plankton'; the summer of 1976 was exceptionally hot and dry for a prolonged period. *Chrysopa pallens* was also recorded at the same period but, interestingly, was also recorded again in 1979. Perhaps it is still present? It is a common species in suburban gardens and appears to be able to thrive on a wide range of deciduous tree species. *Dichochrysa ventralis* is less frequently found than *D. prasina* but is, nevertheless, a widespread and common lacewing on a variety of deciduous trees. *Nineta vittata* may prefer woodlands, from choice, but also turns up in light traps in suburban gardens whilst the absence of *Wesmaelius nervosus* is a complete mystery as it is a common species in the general area.

As far as the Mecoptera are concerned, the absence of the elusive snow-flea *Boreus hyemalis* is perhaps less of a surprise than that of the two common scorpion flies, *Panorpa communis* and *P. germanica*. Evidence from much field survey over the past twenty years appears to reveal some sort of association between these species and stinging nettles *Urtica dioica* growing in the presence of brambles *Rubus fruticosus* agg. On the other hand, it is possible that the general mix of rank herbage and scrub, combining to form the right sort of cover, is more important and that coincidence has it that these two plant species regularly combine to form the same conditions. Either way, this type of habitat is absent from Buckingham Palace Garden, but there is a very high likelihood of one or both scorpion flies colonising the Garden should these correct conditions ever be created.

Conclusions

There are always new species to be added to the list for any site and it is more or less impossible ever to be in a position to state that a survey is completed! However, there are some occasions where one can come close, and a survey of a walled, isolated, green oasis in the central urban sprawl of London might just be such an example. If one assumes that the post-1979 Middlesex list provides a pool of available species, only four, *Chrysopa pallens, Dichochrysa ventralis, Nineta vittata* and *Wesmaelius nervosus*, are at all likely to remain under recorded in Buckingham Palace Garden. Although further light trapping will most likely attract additional species that might merely be passing overhead, it is at least moderately safe to conclude that the list of Neuropterida and Mecoptera obtained is more or less fully representative of the currently resident species.

An annotated list of the Neuropterida and Mecoptera recorded in Buckingham Palace Garden

Sequence and nomenclature follow Plant (1994), except that genus *Dichochrysa* is used in place of *Mallada*, in accordance with Yang and Yang (1990). Species found in the 1961–1963 survey, but not in the present study, are enclosed in round brackets. Taxa recorded in the years between 1963 and 1981, and listed in Kirby (1981) are annotated with a hash (#). Taxa recorded in both the 1960s and 1990s surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey or are reported now for the first time. Species entries entirely enclosed within square brackets are erroneously recorded species, mentioned here because they have been published previously.

NEUROPTERIDA

NEUROPTERA

CONIOPTERYGIDAE

Conwentzia psociformis (Curtis, 1834)

Single males were identified in Malaise trap samples for 20–27.vii.1995, 3–10.viii.1995 and 31.viii.–7.ix.1995. Males were occasionally disturbed from a variety of deciduous bushes and trees, and one from ivy, during visits in July. Females, of which several were encountered, cannot be separated reliably from *C. pineticola* Enderlein. This is a common species in London, but is hopelessly under recorded and is doubtless missed in light trap and Malaise trap samples because of its minute size. It is evidently a well-established species in Buckingham Palace Garden.

Conwentzia pineticola Enderlein, 1905

Single males were identified in Malaise trap samples for 20–27.vii.1995 and 3–10.viii.1995. These are the only records for this species here, the presence of which was not noted in Britain until the 1970s (Barnard 1978) when it was realised that examination of male genitalia is critical to correct determination. Evidence from Rothamsted Insect Survey light traps across Britain suggests, however, that it is equally common and widespread as *C. psociformis*. My earlier statement (Plant 1994) that it appears to be strictly associated with Scots pine *Pinus sylvestris* appears to hold true. These trees are invariably present in the vicinity of all British records and are, indeed, present in Buckingham Palace Garden (McClintock and Lane *antea*, 46).

Coniopteryx (Coniopteryx) tineiformis Curtis, 1834

Eleven males were present in Malaise trap samples for July and August for all three years of the present survey. This is a widespread and common species across the whole of the British Isles and is also frequent in the London Area. The larvae can be found by careful searching on a variety of deciduous trees, though they were not searched for in Buckingham Palace Garden.

Coniopteryx (Coniopteryx) borealis Tjeder, 1930

At the time of Killington's 1936 monograph, *C. borealis* was known only from two specimens collected in Scotland in 1903 and 1934. A specimen collected in Surrey in 1895 was found under the label of '*tineiformis*' in the National Museum of Wales (Plant 1994). In recent years, however, examination of the male genitalia of examples from the Rothamsted Insect Survey light traps, and other sources, has shown that this species is widespread and very common across Britain (though there are no Irish records at present). In Buckingham Palace Garden nine examples were found in the Malaise trap samples for July and August in 1995 and 1996 and a male was taken in the light trap on 8 June 1995.

#*Semidalis aleyrodiformis* (Stephens 1836)

Kirby (1981) records this species as a single female from the m.v. trap in the Garden on 5.viii.1974. The reliability of determinations based upon females in the Coniopterygidae is, even today, generally unreliable. However, the genus was at that time represented in Britain by only a single species: *S. pseudouncinata* Meinander was not added until 1990 and is regarded as a new arrival on imported Cupressaceae (Plant 1992). The record is, therefore, taken as reliable.

Semidalis pseudouncinata Meinander, 1963

A single male of this small wax-fly was collected in the light trap on The Mound on 28.vii.1995 and represents the only example of this species for the Garden and a new vice-county record for Middlesex. A recent colonist to Britain, it was first noted at Writtle, Essex and Wisley, Surrey during 1990 (Plant 1992b); the Buckingham Palace record rather neatly connects the two from either side! It is associated with ornamental Cupressaceae and was probably artificially aided in its arrival in Britain. However, in the years prior to 1990 it seemed to exhibit a gradual northwards progression across Europe (P. Leraut, pers. comm.); a species introduced with horticultural items might be expected to jump to new areas rather than show a gradual range expansion.

SISYRIDAE

#*Sisyra fuscata* (Fabricius, 1793)

Kirby (1981) lists records from the m.v. trap as follows: 1♂ on 13.viii.1973; 3♀♀ on 4.viii.1975; 1♂1♀ on 8.viii.1975; 1♂ on 3.x.1975; 1♂ on 27.vi. 1979. He clearly missed the record from the same trap on 13.viii.1978. The present survey revealed only a single record, of 1♂ in the Malaise trap sample for 5–20.v.1995. The larvae of this species live as internal parasites in freshwater sponges, of which none is so far recorded from Buckingham Palace Garden. Winter is passed in the prepupal stage and once emerging adults have mated, eggs are laid in clusters under branches, bridges or other objects overhanging water. After hatching, the first instar larva drops into the water below. The failure to record this species during the current survey, other than as a single specimen in the Malaise trap is scarcely surprising.

HEMEROBIIDAE

#*Micromus variegatus* (Fabricius, 1793)

Kirby (1981) lists single females in the light trap on 12.vii.1974 and 13.viii.1979. Perhaps surprisingly, there are no other records available. It is associated with tall grasses and rank herbage, often in association with bushes. The majority of British records are from pitfall traps, though it is occasionally taken in light traps or captured in sweep-net samples.

Micromus paganus (Linnaeus, 1767)
Prior to the present survey, three were taken in the light trap by John Bradley on 11.v.1981 and another on 2.vi.1983. All current records are from the Malaise trap, with one male in the sample for 7–20.v.1995, four males in that for 6–18.vi.1996 and one male in that for 24.iv.–15.v.1997. This is an extremely common species in the London Area, though almost all records are made at light traps. There is a strong association with low herbage and the larvae are almost certainly predators of root aphids. Presumably in a garden site, where there is constant disturbance of the soil, there will be few areas where root aphids can become established for long enough to support *Micromus* lacewings?

Hemerobius humulinus Linnaeus, 1761
This is evidently a common species in the Garden, as elsewhere in London and the rest of Britain. It comes freely to light traps so it is rather a surprise that Kirby (1981) did not record it. In total, 25♂♂ and 11♀♀ were caught in the Malaise trap over the three-year survey period; the records span the period of May to August, though with a small peak in July. Adults of both sexes were regularly beaten from shrubbery and trees in July 1996 and were also noted in the light trap.

Hemerobius stigma Stephens, 1836
A single female taken in the light trap on The Mound on 13.vii.1995, and a second female in that trap on 24.viii.1995, are the only records. This relatively widespread and common species is strictly associated with pine trees, showing a preference for Scots pine *Pinus sylvestris,* but not exclusively so, and rarely wanders far from areas where the trees are present.

#*Hemerobius nitidulus* Fabricius, 1777
A single male recorded by Kirby (1981) in the light trap for 13.viii.1979 is the only record. Kirby commented that this was an unexpected species associated with conifers and that it was probably a contemporary introduction.

Hemerobius micans Olivier, 1792
Available evidence from across the British Isles suggests that this brown lacewing is strictly associated with oak trees. In Buckingham Palace Garden all records emanate from the Malaise trap on The Mound, 24♂♂ and 17♀♀ over the three-year period, with records from May to October inclusive. It is most surprising that this species was not recorded by Kirby (1981) as it comes regularly to m.v. light traps.

#*Hemerobius lutescens* Fabricius, 1793
One male and one example with no abdomen are recorded by Kirby (1981) in the light trap for 4.viii.1975 and a single male was in the trap on 15.vi.1976. In the present survey, records are also surprisingly sparse. The Malaise trap records 1♂1♀ from 7–20.v.1995, 2♀♀ from 27.vii.–3.viii.1995, 1♂ from 10–17.viii.1995 and 2♂♂ from 25.iv.–15.v.1997 whilst there was a male in the light trap sample for 8 June 1995. None were found by beating or sweeping vegetation and, surprisingly, there are no other records of this normally widespread and very common species.

*#*Wesmaelius (Kimminsia) subnebulosus* (Stephens, 1836)
Richards (1964) noted this species at light in the Garden in July, September and October, adding that it was then common in London parks and gardens. Records listed by Kirby (1981) indicate that this brown lacewing was regular in the 1970s in the light trap: 1♀ on 19.vii.1972; 1♀ in v.1973; 1♀ on 12.vii.1974; 2♂♂ on 4.viii.1975; 1♂ on 6.viii.1975; 2♀♀ on 8.viii.1975; 1♀ on 28.vi.1976; 1♂ on 29.ix.1977; 1♂ on 13.viii.1979. For the present survey, 41♂♂ and 11♀♀ are recorded from the Malaise trap between 7 May 1995 and 18 August 1997, covering the months from May to August. In addition, both sexes were regularly beaten from bushes during visits in the same months, and also in September, and single examples of females were taken in the light trap on 13 and 20.vii.1995. Of particular interest was a single female, apparently hibernating in a curled leaf caught up in bushes in the Garden, on 21.ii.2000, which I discovered whilst searching for over-wintering *Chrysoperla carnea.* This seems to be the first record of this species during the winter period in Britain. Interestingly, however, there are previous records of overwintering by this species further south in Europe. According to Laffranque and Canard (1975), 'All stages endure cold .... When the imagos (*sic*) over-winter, mating, vitellogenesis and oviposition occur if they receive suitable food'. Their work was carried out in the Toulouse region of south-west France.

#*Sympherobius (Sympherobius) pygmaeus* (Rambur, 1842)

Kirby (1981) lists examples from the light trap as follows: 1♂ on 9.vi.1976; 1♂ on 14.vi.1976; 2♂♂1♀ -on15.vi.1976. During the present survey there was a single female in the light trap on 28.vii.1995 . This species is seldom encountered other than at light traps or in Malaise traps; it is apparently confined to oak trees.

CHRYSOPIDAE

[*Chrysopa phyllochroma* Wesmael, 1841.
Recorded in error by Kirby (1981). See discussion under *Chrysopa commata*].

#*Chrysopa commata* Kis & Ujhelyi, 1965

Kirby (1981) describes a single female green lacewing, taken in the light trap for 9.vi.1976 and, after a somewhat lengthy discussion, dismisses all British records of *C. commata* (including this one), as being *C. phyllochroma*. It is clear from the discussion that Kirby did not regard the two taxa as being validly separate species. Modern opinion differs, however, and Kirby's description of the Buckingham Palace specimen as having dark lateral thoracic sutures clearly indicates that the specimen was *C. commata*. There are no other records from the Garden. Elsewhere in Britain, *C. commata* is widespread, but very local, in the southern half of England, whilst *C. phyllochroma* extends over the same geographical area, but is either numerically rare or else is difficult to find (Plant 1994).

#*Chrysopa perla* (Linnaeus, 1758)

Kirby (1981) lists a single example, without an abdomen, in the light trap sample for 12.vi.1970. For the present survey there are two records, both of single females, in the Malaise trap for the fist week of July and the first week of August, both in 1995. There are no other records of this very common London species, which is generally associated with rank herbage, especially grassland with scattered scrub.

#*Chrysopa pallens* (Rambur, 1838)

Three separate females were taken in the light trap, with one each on 22.vii.1975, 1.vii.1976 and 12.ix.1979 (Kirby 1981). There are no other records. This is the *Chrysopa septempunctata* Wesmael of many recent texts.

*#*Chrysoperla carnea* agg.

In recent years Henry et al. (1996; 1999; submitted) have shown that what was previously understood to be *Chrysoperla carnea* in Western Europe is in fact a complex of five cryptic species. They can be segregated on the basis of their unique substrate-borne courtship 'songs', and the morphology of the genital lip at the apex of the male abdomen. Of these five taxa, three occur in Britain. All three are recorded in Buckingham Palace Garden, but old records for which there is no voucher specimen cannot be segregated. Work is still in progress to establish the correct scientific names for two of these species (Henry et al., submitted) so in this paper they are referred to informally as *Chrysoperla* sp. A and *Chrysoperla* sp. B. Henry et al. (submitted) provide a full morphological description of how to distinguish adults and larvae of these two species.

Chrysoperla lucasina (Lacroix, 1912)

In fresh specimens, and those preserved in alcohol, this species can be distinguished by the dark brown, chitinised stripe on the membrane between tergites and sternites, positioned adjacent to the margin of sternites 1 to 3. The diagram of this feature in Plant (1997), as well as the characters given in the key in that work, is misleading and should not be used. Pinned specimens are best treated for a short period in potassium hydroxide and then stored in alcohol before correct identification can be carried out. *C. lucasina* appears to be very widespread in Britain, and is likely to be found in most areas, though it is numerically rare compared to species B, below. In Buckingham Palace Garden, the Malaise trap produced just a single example — a female in the sample for 23.ii.–25.iii.1996. This compares with totals for the three-year period of 56 species A and 37 species B. Another single example, this time a male, was found in the light trap sample for 20.vii.1995.

Chrysoperla species A

This is segregate *Cc2* of Duelli, the 'slow motorboat' song morph *sensu* Henry and *Ch. carnea sensu* Cloupeau. At present, Buckingham Palace Garden is the only confirmed British locality for this segregate, although there are unconfirmed samples from another London site (within South Essex, vice-county 18) where I found examples in Malaise trap samples collected in 1994. At Buckingham Palace, the Malaise trap records 56 examples (35♂♂, 21♀♀) between 20 April 1995 and 18 August 1997, affecting every month of the year except June, providing clear evidence that this segregate overwinters in Britain as an adult. The gap in records for June is unexpected, but may indicate a break between generations. Active searching for this species in the Garden was undertaken by Stephen Brooks and myself on 21 February 2000. A search of the buildings proved to be fruitless, but our spirits rose when adult lacewings, in both green and brown colour phases, started to fall into our beating tray from cherry laurel *Prunus laurocerasus* bushes. Close examination of the habitat showed that most lacewings were inside dried, folded and rolled leaves of plane *Platanus* × *hybridus* trees that had become deeply lodged in the evergreen bushes; most were in bushes that received direct sunlight and were sheltered from the wind. Both species A and B were found in this situation.

Chrysoperla species B

This is segregate *Cc4* of Duelli, the 'motorboat' song morph *sensu* Henry (Henry et al. 1996; 1999; submitted) and Ch. kolthoffi sensu Cloupeau. This segregate species is widespread and numerically abundant over the whole of Great Britain, though information is not currently available from Ireland. It is, however, less common than species A in Buckingham Palace Garden — itself an interesting discovery. In total 37 examples (19♂♂ and 18♀♀) were collected by the Malaise trap over the same time period as the 56 of species A, above. Examples were also found hibernating inside curled-up leaves of plane trees in the same situation as species A and occasionally in the light trap. Records are distributed across all months of the year except December.

* *Cunctochrysa albolineata* (Killington 1935)

Richards (1964) records this species 'at light and on shrub' for June and July in the 1961 to 1963 survey. Kirby (1981) lists two males in the light trap for 4.viii.1975. A larva collected during September 1982 by Stephen Brooks emerged as an adult on 23 May 1983. The present survey records a total of 6♂♂ and 4♀♀ in the Malaise trap over the months of May to September but, interestingly, none was found during active survey work. It is a very common species in London with only taxa in the *Chrysoperla carnea* complex being more numerically abundant in light traps.

Dichochrysa flavifrons (Brauer, 1850)

This is a widespread and common species in England and Wales, though it is recorded only once in Ireland and is apparently absent from Scotland. In the south-east of England it is frequent at light traps and there is some unpublished numerical data to suggest that resident populations are boosted by autumn immigration from Europe. Surprisingly, however, there is only a single record from Buckingham Palace Garden — a female in the Malaise trap sample for 23–30.vi.1995.

Dichochrysa prasina (Burmeister, 1839)

This is a common species in suburban gardens, including in London, though there are no other records to date for the central area than the present one of a single female in the Malaise trap sample for 20–27.vii.1995.

Nineta flava (Scopoli, 1763)

Absent from both the 1961–1963 list and from Kirby's 1981 report, this species was first recorded from the Garden on 27.vii.1981, when John Bradley collected a single example from the light trap. It is represented in the 1990s survey by just two examples, both in the Malaise trap samples — 1♀ from 23–30.vi.1995 and 1♀ from 27.vi.–11.vii.1996. Killington (1937) recorded this large green lacewing by beating hazel, lime, oak and beech, whilst Kirby (1981) asserted that it might be expected in Buckingham Palace Garden because it has a strong association with *Acer*. However, as I have previously stated (Plant 1994), there is a strong association with oak, and oak trees have proved, in situations where checking has been possible, to be in the vicinity of all other trees from which examples of the lacewing have been disturbed. If there truly is an association with *Acer* trees (sycamore or London planes) then one might expect the species to be tolerably common in the central area of London, including in Buckingham Palace Garden, but the reality seems to be that it is genuinely rare here (though it is common in the suburbs). Oak is present in the Garden, and clearly supports a population of *Hemerobius micans*.

#*Nothochrysa capitata* (Fabricius, 1793)

A single female from the light trap on 25.vi.1974 is listed by Kirby (1981). An earlier female was collected by John Bradley from the light trap on 23.vii.1969 whilst more recently Peter Chandler collected a single female in the Garden on 26.vi.1998. These appear to be the only records of a species that seems to have an association with pine trees.

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Plate H. Buckingham Palace Garden, London. Tree-dominated edge-habitats, such as here alongside Grosvenor Place, are important for many species of insects.

Photographed © by Mark Lane

The Butterflies and Moths (Lepidoptera) of Buckingham Palace Garden

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Abstract

Lepidoptera have been monitored over a period of 40 years in Buckingham Palace Garden, mostly by use of a mercury vapour (m.v.) light trap sited near the western end of the lake. During that period, a total of 640 species have been recorded, comprising 23 butterflies and 617 moths. A little over half of the records (343 species), were made during the four-year survey of the natural history of the Garden from 17 June 1960 to 15 September 1964. In 1965, a further 22 species were recorded, bringing the total to 365. During the following ten years, the total increased to nearly 500, an average of 12 to 14 additional species annually and from then onwards this has gradually declined to just a few species each year. The present inventory represents about 25 per cent of the British lepidopteran fauna. Noteworthy among the moths from the Garden are three species previously unknown from the British isles, *viz. Monochroa hornigi* (Gelechiidae), *Eccopisa effractella* (Pyralidae)and *Earias biplaga* (Noctuidae), the Spiny Bollworm. A synoptic collection of specimens from the garden is maintained in The Natural History Museum, London.

Introduction

The first systematic recording of Lepidoptera at Buckingham Palace Garden was carried out by John Bradley and Robin Mere as part of a survey of the natural history of the garden carried out between June 1960 and September 1964 (Bradley & Mere 1964). During that period a remarkable total of 343 species was listed. Bradley and Mere continued recording and two years later a further 25 species were listed (Bradley & Mere 1966). Bradley continued running the m.v. trap for the next 23 years, and was then joined by the present author who eventually took over observations in 1991, continuing until the present day. After the supplementary list of 1966, no further list was published so that the present account provides new records for a period of over thirty years.

Collecting methods

Most specimens have been collected by use of a Robinson-pattern mercury vapour light trap (see Plate D in Part 1 of this *Supplement*). During the first survey, this was situated in a small open space at the western end of the mound and on a few occasions was run by the lakeside (Bradley & Mere 1966). By the time the current survey was started, the trap had been moved to a small clearing on the mound at the south-western side of the lake. Because of the growth of trees over the years, the site is much more enclosed than it was during the first survey and this, together with increased light pollution in London has meant that the trap is much less efficient and catches are now much smaller. This may be a major factor in accounting for the larger number of species recorded during the first survey. The trap was usually run on one or two nights each week from spring until autumn. The trap was switched on at dusk by a member of the gardening staff and switched off and covered on the following morning. Originally, the trap was checked in the early afternoon, but for part of the survey period it was checked in the early morning to avoid losses.

A considerable number of microlepidoptera species have been recorded from leaf mines, notably during a visit by the late Maitland Emmet in 1997. No doubt a more intensive search for leaf mines would reveal additional species. For the current insect survey, a Malaise trap (see Plate E in Part 1 of this *Supplement*), was also set up on the mound at its eastern end, but this has only produced one notable Lepidoptera record — a single specimen of *Synanthedon vespiformis*, the Yellow-legged Clearwing — the only record of this species for the garden.

Butterflies and day-flying moths have mostly been observed visiting flower borders or attracted to *Buddleja* in the shrubberies.

Discussion

It is difficult to draw any useful conclusions about the many species only recorded once or a few times over the years as this inevitably happens with a group of highly mobile insects such as the Lepidoptera, particularly when they are mainly collected by light trapping. It is quite possible that many of these are resident in the garden but a great deal more work would be necessary to verify this. However, a number of interesting trends have been noticed for some more regularly recorded species.

During the first survey, Bradley & Mere noted that the most common macrolepidoptera in the trap were *Noctua pronuba*, the Large Yellow Underwing, *Mamestra brassicae*, the Cabbage Moth, *Paradrina clavipalpis*, the Pale Mottled Willow and *Lycia hirtaria*, the Brindled Beauty. In the current survey, since 1995, *Noctua pronuba* and *Paradrina clavipalpis* have remained amongst the most common species but the other two species have only been recorded occasionally. Bradley & Mere commented on the relatively low number of Geometridae recorded, citing the fact that many species are not captured by m.v. traps as one of the reasons for this. The current survey has produced even less Geometridae and this may be partly because the trap is now more shaded by surrounding trees and partly because there has not been the opportunity for the type of evening collecting that was carried out during the first survey when Palace security was not so rigorous as it is today.

Among the microlepidoptera, the most common species during the first survey were the tortricid moth, *Rhopobota naevana* and the gelechiid *Carpatolechia fugitivella*. Although both of these species have been recorded during the current survey, they have certainly not occurred in large numbers. However, two species of Blastobasidae, *Blastobasis decolorella* and *B. lignea*, have become extremely common. Both of these species originate from Madeira but are now well established in England. They are both detritus feeders and there is a possibility that their dramatic increase in numbers may be linked to more environmentally sensitive gardening methods now employed at the Palace, including the extensive use of 'home produced' compost for mulching. The most common tortricid moth is now *Epiphyas postvittana*, the Light Brown Apple Moth, another introduced species originating from Australia and discovered in the mid-1930s breeding in Devon and Cornwall. It was first recorded in the garden in 1989, but has significantly increased in numbers during the current survey period. It feeds on the foliage of a wide range of shrubs and garden plants and is almost certainly breeding in the garden. Its sudden increase may be linked with climatic change.

The influence of climatic change is difficult to prove but it is interesting to note that *Euproctis chrysorrhoea*, the Brown-tail Moth, first recorded in the garden in 1967 (Bradley 1984) was not seen again until 1976, but by 1983 was occurring in large numbers and has been recorded regularly since then. This species was previously regarded as surviving at the edge of its range in Britain, being largely confined to a few areas along the south-east coast of England with occasional incursions along the Thames estuary into London.

Climatic change may also be partly responsible for the extending range of some of our butterflies. *Pararge aegeria*, the Speckled Wood, was first recorded in the garden in 1972, but by 1995 had become quite a common sight and is almost certainly breeding there now. This may have been helped by current mowing regimes in some of the wilder areas of the garden, as the larvae feed on grasses. In the first survey, *Celastrina argiolus*, the Holly Blue, was described as the only butterfly species regularly breeding in the garden. This species reached a peak in 1989, but has remained in good numbers each year since then.

An interesting butterfly record, which requires some explanation, is that of *Lycaena dispar*, the Large Copper, a species extinct in the wild in Britain since the 1850s. The following account was kindly supplied by Bradley:

> 'The Water Dock (*Rumex hydrolapathum*) had been specially planted by the lake in 1976 and early 1977 for a trial release of Large Coppers being reared by the Reverend Tony Harbottle, chaplain at Windsor. He had released a number of butterflies in the morning on 3rd August. A gardener, not knowing about this, saw one and managed to catch it with his cap and put it in a match box which he presented to Dr Bradley when he came to inspect the m.v. trap in the afternoon, saying "I've got a good one here!"'

One of the more interesting new records, *Lithophane leautieri*, Blair's Shoulder-knot, discovered in Britain on the Isle of Wight in 1951, made its first appearance in the garden in 1989 and has been recorded quite regularly since then. Its larvae feed on *Cupressus* spp. and its appearance may be linked with the extensive planting of ornamental conifers in London which became practicable following diminished sulphur dioxide pollution levels. *Blastobasis lignea* is also known to feed on conifers, which may partly explain the huge explosion in its numbers. The appearance of *Caloptilia azaleella*, the Azalea Leaf Miner, coincided with extensive plantings of *Rhododendron* in the 1970s, also made possible by reduced sulphur dioxide pollution. Reduced pollution may also account for increasing numbers of the lichen-feeding *Cryphia domestica*, the Marbled Beauty, a species that was only noted twice during the first survey.

Two new records of leaf-mining microlepidoptera have followed recent accidental introductions from the continent. *Phyllonorycter leucographella*, the Firethorn Leaf-miner, a southern European species, was first recorded in Essex in 1989 (Emmet 1989), and in 1990 leaf mines were found on *Pyrracantha* growing along the wall of the Back Path. *Phyllonorycter platani*, a native of south-eastern Europe, mining the leaves of Plane (*Platanus*), was first recorded in South Kensington, London in 1991 (Emmet 1991), but was not noted in the palace garden until 1995, although it was quite probably present before then. It is difficult to know whether climatic shifts played a part in the arrival of these moths but *Phyllonorycter leucographella* almost certainly came into the country on nursery stock.

Perhaps the most exciting find during the current survey period was a single specimen of the pyralid moth *Eccopisa effractella*, a species new to the British Isles (Agassiz 1996). This is a widely distributed species in continental Europe but most likely arrived here as a casual importation. The larvae are said to feed on spun shoots of cultivated Apple, *Malus sylvestris*, with Plum, *Prunus* and Hazel, *Corylus*, as alternative foodplants, so it is feasible that the species could become established here. The gelechiid moth *Monochroa hornigi*, recorded as new to Britain in the first survey was subsequently taken in the light trap in 1963, 1984 and 1987 and has since been recorded as far north as south-east Yorkshire (Bradley 2000). Also, the noctuid moth *Earias biplaga*, Spiny Bollworm, first recorded from the Palace garden in July 1964, has since been recorded elsewhere in southern England (Bradley 2000).

An annotated list of Lepidoptera recorded in Buckingham Palace Garden

With the exception of the butterflies all records are of specimens taken at m.v. light unless otherwise indicated. Species marked * were recorded in the first report by Bradley & Mere in 1964, while those marked ** were recorded in the supplementary list published by Bradley and Mere in 1966. Species in bold have been recorded during the current survey (from 1995 onwards). Species listed as 'first recorded' have been recorded more than once, while those listed as 'recorded' only appear to have been noted once. Nomenclature follows Bradley (2000).

LEPIDOPTERA

ERIOCRANIIDAE

Eriocrania subpurpurella (Haworth, 1828)
First recorded 8.v.1970.

* *Eriocrania unimaculella* (Zetterstedt,1839)

HEPIALIDAE

** *Hepialus humuli* (Linnaeus, 1758), Ghost Moth

Hepialus sylvina (Linnaeus, 1761), Orange Swift
Recorded 16.viii.1974.

Hepialus hecta (Linnaeus, 1758), Gold Swift
Recorded 23.vii.1967.

* ***Hepialus lupulinus* (Linnaeus, 1758)**, Common Swift.
Quite common during the current survey period in May & June, sometimes in large numbers.

NEPTICULIDAE

Bohemannia pulverosella (Stainton, 1849)
Leaf mines recorded by Bradley between 1965 and 1989 on apple (*Malus*) in the kitchen garden.

Etainia decentella (Herrich-Schäffer, 1855)
First recorded 21.vii.1975.

***Ectoedemia louisella* (Sircom, 1849)**
Recorded 24.viii.1995.

* *Ectoedemia albifasciella* (Heinemann, 1871)

Ectoedemia septembrella (Stainton, 1849)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

* ***Stigmella lemniscella* (Zeller, 1839)**
Leaf mines subsequently recorded by Emmet & Plant 31.viii.1997.

***Stigmella speciosa* (Frey, 1858)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Stigmella obliquella* (Heinemann, 1862)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

* *Stigmella trimaculella* (Haworth, 1828)

***Stigmella tityrella* (Stainton, 1854)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Stigmella perpygmaeella* (Doubleday, 1859)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, also recorded by Bradley between 1965 and 1989 but no further data could be traced.

* *Stigmella ulmivora* (Fologne, 1860)

* *Stigmella atricapitella* (Haworth, 1828)

Stigmella ruficapitella (Haworth, 1828)
Leaf mines recorded by Bradley between 1965 and 1989 but no further data could be traced.

***Stigmella suberivora* (Stainton, 1869)**
Vacated leaf mine on Holm Oak, *Quercus ilex,* 13.vi.1996, first record.

***Stigmella anomalella* (Goeze, 1783)**, Rose Leaf Miner
Leaf mines recorded several times by Bradley between 1965 and 1989 but no exact data could be traced , also recorded by Emmet & Plant 31.viii.1997.

***Stigmella centifoliella* (Zeller, 1848)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

* *Stigmella hybnerella* (Hübner, 1796)

* *Stigmella oxyacanthella* (Stainton, 1854)

***Stigmella crataegella* (Klimesch, 1936)**
24.viii.1995 at m.v., leaf mines recorded by Emmet & Plant 31.viii.1997; also recorded by Bradley between 1965 and 1989.

TISCHERIIDAE

***Emmetia marginea* (Haworth, 1828)**
First recorded 8.viii.1983.

HELIOZELIDAE

Heliozela sericiella (Haworth, 1828)
Recorded 20.v.1982, first Middlesex record.

COSSIDAE

* *Zeuzera pyrina* (Linnaeus, 1761), Leopard Moth

ZYGAENIDAE

* *Zygaena trifolii* (Esper, 1783), Five-spot Burnet
Caught during the daytime. This specimen belongs to the chalk soil form *palustrella*, Verity, 1926, a very unusual occurrence as the nearest records are from the North Downs in Kent and Surrey (Plant, 1993).

* *Zygaena lonicerae* (Scheven, 1777), Narrow-bordered Five-spot Burnet
Caught during the daytime.

PSYCHIDAE

Dahlica inconspicuella (Stainton, 1849)
Larva found in m.v. trap 1.vi.1995, first record.

TINEIDAE

Morophaga choragella (Denis & Schiffermüller, 1775)
Recorded 20.vi.1979.

Nemapogon cloacella (Haworth, 1828), Cork Moth
Recorded 30.v.1996.

Nemapogon variatella (Clemens, 1859)
First recorded 20.v.1982.

* *Monopis laevigella* (Denis & Schiffermüller, 1775), Skin Moth.
* *Monopis obviella* (Denis & Schiffermüller, 1775)
* *Monopis crocicapitella* (Clemens, 1859)

Monopis imella (Hübner, 1813)
Recorded 21.viii.1997.

* **_Tineola bisselliella_ (Hummel, 1823)**, Common Clothes Moth

Niditinea fuscella (Linnaeus, 1758), Brown-dotted Clothes Moth
Recorded 7.vi.1988.

* **_Tinea columbariella_ Wocke, 1877**

Tinea pellionella Linnaeus, 1758, Case-bearing Clothes Moth
First recorded 6.viii.1979.

* *Tinea pallescentella* Stainton, 1851, Large Pale Clothes Moth

Tinea trinotella Thunberg, 1794
First recorded 14.vii.1969.

BUCCULATRICIDAE

Bucculatrix maritima Stainton, 1851
First recorded 19.viii.1966.

* *Bucculatrix frangutella* (Goeze, 1783)

Bucculatrix albedinella Zeller, 1839
First recorded 3.vi.1970

Bucculatrix thoracella (Thunberg, 1794)
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

** *Bucculatrix ulmella* Zeller, 1848

ROESLERSTAMMIIDAE

* *Roeslerstammia erxlebella* (Fabricius, 1787)

GRACILLARIIDAE

Caloptilia betulicola (Hering, 1927)
Recorded 1.vii.1976.

Caloptilia azaleella (Brants, 1913), Azalea Leaf Miner
First reared from mines 18-20.ix.1974.

* ***Caloptilia alchimiella* (Scopoli, 1763)**

***Caloptilia robustella* Jäckh, 1972**
First recorded 11.vi.1996.

* ***Caloptilia stigmatella* (Fabricius, 1781)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

***Caloptilia falconipennella* (Hübner, 1813)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record. First Middlesex record.

* *Caloptilia syringella* (Fabricius, 1794)

Calybites phasianipennella (Hübner, 1813)
Recorded 24.vii.1981

Parornix betulae (Stainton, 1854)
First recorded 24.vii.1972

Parornix fagivora (Frey, 1861)
First recorded 11.viii.1975, first Middlesex record.

***Parornix anglicella* (Stainton, 1850)**
First recorded 17.vii.1964, leaf mines subsequently recorded by Emmet & Plant 31.viii.1997.

***Parornix devoniella* (Stainton, 1850)**
Recorded by Bradley between 1965 and 1989 but no further data could be traced, leaf mines recorded by Emmet & Plant 31.viii.1997.

***Parornix scoticella* (Stainton, 1850)**
First recorded 14.vii.1967, leaf mines recorded by Emmet & Plant 31.viii.1997.

***Callisto denticulella* (Thunberg, 1794)**
First recorded in the kitchen garden, 18.vi.1986, leaf mines recorded by Emmet & Plant 31.viii.1997.

***Acrocercops brongniardella* (Fabricius, 1798)**
13.vi.1996, mines on *Quercus*.

* ***Phyllonorycter harrisella* (Linnaeus, 1761)**
Several records at m.v., also leaf mines.

***Phyllonorycter heegeriella* (Zeller, 1846)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

* ***Phyllonorycter messaniella* (Zeller, 1846)**
Common.

***Phyllonorycter platani* (Staudinger, 1870)**
First recorded 3.viii.1995 at m.v.; leaf mines subsequently recorded by Emmet & Plant 31.viii.1997.

* ***Phyllonorycter oxyacanthae* (Frey, 1856)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

* ***Phyllonorycter blancardella* (Fabricius, 1781)**
Recorded from the kitchen garden by Bradley between 1965 and 1989, but no additional data could be traced, ?leaf mines recorded by Emmet & Plant 31.viii.1997 [possibly *Phyllonorycter cydoniella* (Denis &Schiffermüller 1775)].

* *Phyllonorycter spinicolella* (Zeller, 1846)

* ***Phyllonorycter corylifoliella* (Hübner, 1796)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

***Phyllonorycter leucographella* (Zeller, 1850)**, Firethorn Leaf Miner
Mines first recorded by Bradley in 1990. Halstead also recorded mines on *Pyrracantha* during the current survey period.

* ***Phyllonorycter maestingella* (Müller, 1764)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

***Phyllonorycter coryli* (Nicelli, 1851)**, Nut Leaf Blister Moth
Recorded by Bradley between 1965 and 1989, but no further data could be traced. Leaf mines recorded by Emmet & Plant 31.viii.1997.

* *Phyllonorycter rajella* (Linnaeus, 1758)
Leaf mines on Alders (*Alnus glutinosa*) by the lake.

* *Phyllonorycter tristrigella* (Haworth, 1828)

***Phyllonorycter stettinensis* (Nicelli, 1852)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Phyllonorycter froelichiella* (Zeller, 1839)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Phyllonorycter nicellii* (Stainton, 1851)**
Recorded by Bradley between 1965 and 1989 but no further data could be traced, leaf mines recorded by Emmet & Plant 31.viii.1997.

** ***Phyllonorycter kleemannella* (Fabricius, 1781)**
Leaf mines recorded by Emmet & Plant 31.viii.1997.

Phyllonorycter trifasciella (Haworth, 1828)
First recorded 9.viii.1974.

***Phyllonorycter platanoidella* (Joannis, 1920)**
Leaf mines recorded by Emmet & Plant 31.viii.1997, first record.

***Phyllonorycter geniculella* (Ragonot, 1874)**
First recorded 16.vii.1982, leaf mines recorded by Emmet & Plant 31.viii.1997.

Phyllocnistis unipunctella (Stephens, 1834)
First recorded 22.viii.1979.

SESIIDAE

Synanthedon tipuliformis (Clerck, 1759), Currant Clearwing
Recorded vii.1976.

***Synanthedon vespiformis* (Linnaeus, 1761)**, Yellow-legged Clearwing
One specimen in Malaise trap 7-20.v.1995, first record.

Synanthedon myopaeformis (Borkhausen, 1789), Red-belted Clearwing
Recorded by Bradley on cultivated Apple (*Malus sylvestris*) in the kitchen garden between 1965 and 1989.

GLYPHIPTERIGIDAE

Glyphipterix simpliciella (Stephens, 1834), Cocksfoot Moth
First recorded 11.v.1989; signs of emergence holes believed to belong to this species had been found in Cock's Foot, *Dactylis glomerata*, stems in previous years.

ARGYRESTHIIDAE

Argyresthia ivella (Haworth, 1828)
First recorded 6.vii.1966.

* *Argyresthia brockeella* (Hübner, 1813)

* ***Argyresthia goedartella* (Linnaeus, 1758)**

* *Argyresthia pygmaeella* (Denis & Schiffermüller, 1775)

***Argyresthia curvella* (Linnaeus, 1761)**
First recorded by Bradley between 1965 and 1989.

* ***Argyresthia retinella* Zeller, 1839**

* *Argyresthia spinosella* Stainton, 1849

Argyresthia semifusca (Haworth, 1828)
Recorded 4.iv.1987.

* ***Argyresthia pruniella* (Clerck, 1759)**, Cherry Fruit Moth

Argyresthia bonnetella (Linnaeus, 1758)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

* *Argyresthia albistria* (Haworth, 1828)

YPONOMEUTIDAE

* ***Yponomeuta evonymella* (Linnaeus, 1758)**, Bird-cherry Ermine

* *Yponomeuta padella* (Linnaeus, 1758), Orchard Ermine

* ***Yponomeuta cagnagella* (Hübner, 1813)**, Spindle Ermine

* *Swammerdamia pyrella* (Villers, 1789)

* *Paraswammerdamia lutarea* (Haworth, 1828)

* ***Prays fraxinella* (Bjerkander, 1784)**, Ash Bud Moth

Scythropia crataegella (Linnaeus, 1767), Hawthorn Moth
First recorded 23.vi.1976.

Ypsolopha dentella (Fabricius, 1775), Honeysuckle Moth
First recorded 18.vii.1967.

* ***Ypsolopha scabrella* (Linnaeus, 1761)**

Ypsolopha horridella (Treitschke, 1835)
First recorded 18.vii.1967.

Ypsolopha sylvella (Linnaeus, 1767)
Recorded 24.viii.1978.

***Ypsolopha ustella* (Clerck, 1759)**
Recorded 13.vii.2001.

* ***Ypsolopha sequella* (Clerck, 1759)**

* *Ypsolopha vittella* (Linnaeus, 1758)

* ***Plutella xylostella* (Linnaeus, 1758)**, Diamond-back Moth
This common migrant comes to m.v. every year, sometimes in large numbers.

* ***Eidophasia messingiella* (Fischer von Röslerstamm, 1840)**

***Digitivalva perlepidella* (Stainton, 1849)**
Recorded 27.vi.1996, first Middlesex record.

LYONETIIDAE

* ***Leucoptera laburnella* (Stainton, 1851)**, Laburnum Leaf Miner

* ***Lyonetia clerkella* (Linnaeus, 1758)**, Apple Leaf Miner

Bedellia somnulentella (Zeller, 1847)
Recorded 12.ix.1979

COLEOPHORIDAE

* ***Coleophora lutipennella* (Zeller, 1838)**

* *Coleophora serratella* (Linnaeus, 1761)

Coleophora spinella (Schrank, 1802), Apple & Plum Case-bearer
First recorded 2.viii.1974

* *Coleophora badiipennella* (Duponchel, 1843)

* *Coleophora limosipennella* (Duponchel, 1843)

Coleophora trifolii (Curtis, 1832)
First recorded 22.vi.1973

Coleophora mayrella (Hübner, 1813)
First recorded 20.vii.1971

Coleophora lineolea (Haworth, 1828)
Recorded 17.vi.1976

Coleophora hemerobiella (Scopoli, 1763)
First recorded 9.viii.1974

Coleophora laricella (Hübner, 1817), Larch Case-bearer
Recorded 17.vi.1981

* *Coleophora albidella* (Denis & Schiffermüller, 1775)

* *Coleophora ibipennella* Zeller, 1849

Coleophora albicosta (Haworth, 1828)
Recorded 6.vi.1966

* *Coleophora follicularis* (Vallot, 1802)

Coleophora trochilella (Duponchel, 1843)
First recorded 18.viii.1961

** ***Coleophora peribenanderi* Toll, 1943**

* *Coleophora sternipennella* (Zetterstedt, 1839)

Coleophora versurella Zeller, 1849
First recorded 22.vi.1973.

* *Coleophora artemisicolella* Bruand, 1855

Coleophora taeniipennella Herrich-Schäffer, 1855
Recorded by Bradley between 1965 and 1989 but no further data could be traced. First Middlesex record.

Coleophora glaucicolella Wood, 1892
First recorded 10.vii.1970.

Coleophora tamesis Waters, 1929
Recorded 2.vii.1971.

* ***Coleophora alticolella* Zeller, 1849**

Coleophora caespititiella Zeller, 1839
Recorded 15.vi.1976.

Coleophora clypeiferella Hofmann, 1871
Recorded 9.viii.1967.

ELACHISTIDAE

* *Elachista atricomella* Stainton, 1849

Elachista luticomella Zeller, 1839
First recorded 28.vi.1968.

* ***Elachista canapennella* (Hübner, 1813)**

* *Elachista rufocinerea* (Haworth, 1828)

Elachista maculicerusella Bruand, 1859
Recorded 3.vi.1970.

OECOPHORIDAE

***Batia lunaris* (Haworth, 1828)**
First recorded 29.vi.1983.

* ***Batia unitella* (Hübner, 1796)**

* ***Hofmannophila pseudospretella* (Stainton, 1849)**, Brown House-moth.
Frequent at m.v.

* ***Endrosis sarcitrella* (Linnaeus, 1758)**, White-shouldered House-moth

* ***Esperia sulphurella* (Fabricius, 1775)**

* ***Carcina quercana* (Fabricius, 1775)**
Occurs regularly at m.v. from June to August.

* *Diurnea fagella* (Denis & Schiffermüller, 1775)

* ***Depressaria daucella* (Denis & Schiffermüller, 1775)**

***Agonopteryx heracliana* (Linnaeus, 1758)**
First recorded 14.x.1966.

***Agonopterix alstromeriana* (Clerck, 1759)**
First recorded 22.x.1976.

* ***Agonopterix nervosa* (Haworth, 1811)**

GELECHIIDAE

Isophrictis striatella (Denis & Schiffermüller, 1775)
Recorded 22.viii.1978.

* *Monochroa hornigi* (Staudinger, 1883)
First published record as new to Britain (Bradley & Mere 1964) was of a specimen taken vi.1963, although subsequently a specimen taken in the garden two years earlier (vi.1961) was also found to belong to this species. Further specimens were recorded in 1984 and 1987.

Chrysoesthia sexguttella (Thunberg, 1794)
Recorded 20.v.1970.

Bryotropha affinis (Haworth, 1828)
First recorded 4.vii.1965.

* *Bryotropha similis* (Stainton, 1854)

Bryotropha senectella (Zeller, 1839)
First recorded 21.vii.1969.

* ***Bryotropha terrella* (Denis & Schiffermüller, 1775)**

***Bryotropha domestica* (Haworth, 1828)**
First recorded 18.ix.1978.

* ***Parachronistis albiceps* (Zeller, 1839)**

* *Recurvaria nanella* (Denis & Schiffermüller, 1775)

Athrips mouffetella (Linnaeus, 1758)
Recorded 25.vii.1975.

* *Teleiodes vulgella* (Denis & Schiffermüller, 1775)

***Teleiodes luculella* (Hübner, 1813)**
Recorded vii.1996.

***Carpatolechia alburnella* (Zeller, 1839)**
First recorded 8.viii.1975.

* *Carpatolechia fugitivella* (Zeller, 1839)

* *Mirificarma mulinella*, (Zeller, 1839)

Aroga velocella (Zeller, 1839)
Recorded 16.vii.1976.

Gelechia rhombella (Denis & Schiffermüller, 1775)
First recorded 27.vi.1966.

***Gelechia senticetella* (Staudinger, 1859)**
Recorded 16.viii.2001

* *Gelechia soroculella* (Hübner, 1817)

* ***Gelechia turpella* (Denis & Schiffermüller, 1775)**

Scrobipalpa ocellatella (Boyd, 1858), Beet Moth
Recorded 11.viii.1975.

* *Scrobipalpa obsoletella* (Fischer von Röslerstamm, 1841)

* *Scrobipalpa atriplicella* (Fischer von Röslerstamm, 1841)

* *Scrobipalpa costella* (Humphreys & Westwood, 1845)

Scrobipalpa acuminatella (Sircom, 1850)
Recorded 26.vii.1967.

* *Caryocolum fraternella* (Douglas, 1851)

* ***Caryocolum proximum* (Haworth, 1828)**
13.vi.1996 larvae in spun florets of Common Chickweed (*Stellaria media*).

** *Sophronia semicostella* (Hübner, 1813)

* *Aproaerema anthyllidella* (Hübner, 1813)

***Anacampsis populella* (Clerck, 1759)**
Recorded 28.vii.1995.

Anarsia spartiella (Schrank, 1802)
Recorded 24.vii.1972.

***Dichomeris marginella* (Fabricius, 1781)**, Juniper Webber
First recorded 23.vii.1969.

* *Brachmia blandella* (Fabricius, 1798)

* ***Helcystogramma rufescens* (Haworth, 1828)**

* *Pexicopia malvella* (Hübner, 1805), Hollyhock Seed Moth

* ***Oegoconia quadripuncta* (Haworth, 1828)**

***Oegoconia deauratella* (Herrich Schäffer, 1854)**
Recorded 20.vii.1995.

BLASTOBASIDAE

* ***Blastobasis lignea* Walsingham, 1894**
Extremely common in July and August, sometimes occurring in very large numbers.

***Blastobasis decolorella* (Wollaston, 1858)**
First recorded 18.vi.1969, now very common.

BATRACHEDRIDAE

* *Batrachedra praeangusta* (Haworth, 1828)

MOMPHIDAE

* *Mompha raschkiella* (Zeller, 1839)

Mompha propinquella (Stainton, 1851)
Recorded 7.vii.1982.

* *Mompha divisella* Herrich-Schäffer, 1854

Mompha sturnipennella (Treitschke, 1833)
First recorded 2.viii.1974.

***Mompha subbistrigella* (Haworth, 1828)**
First recorded 20.viii.1976.

* *Mompha epilobiella* (Denis & Schiffermüller, 1775)

COSMOPTERIGIDAE

* *Blastodacna atra* (Haworth, 1828), Apple Pith Moth

Sorhagenia lophyrella (Douglas, 1846)
Recorded 16.vii.1976. First Middlesex record.

TORTRICIDAE

* ***Agapeta hamana* (Linnaeus, 1758)**

Aethes hartmanniana (Clerck, 1759)
Recorded 18.vi.1971.

Aethes rubigana (Treitschke, 1830)
Recorded 13.vii.1983.

* *Aethes smeathmanniana* (Fabricius, 1781)

Eupoecilia angustana (Hübner, 1799)
Recorded 14.viii.1981.

Cochylidia implicitana (Wocke, 1856)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

Falseuncaria ruficiliana (Haworth, 1811)
Recorded 17.viii.1981. First Middlesex record.

* *Cochylis dubitana* (Hübner, 1799)

Cochylis hybridella (Hübner, 1813)
Recorded 1.vii.1986.

***Cochylis nana* (Haworth, 1811)**
First recorded 3.vi.1970.

***Pandemis corylana* (Fabricius, 1794)**, Chequered Fruit-tree Tortrix
First recorded 8.viii.1975.

* ***Pandemis cerasana* (Hübner, 1786)**, Barred Fruit-tree Tortrix

* ***Pandemis heparana* (Denis & Schiffermüller, 1775)**, Dark Fruit-tree Tortrix

Argyrotaenia ljungiana (Thunberg, 1797)
Recorded 18.viii.1988.

* ***Archips podana* (Scopoli, 1763)**, Large Fruit-tree Tortrix

* ***Archips crataegana* (Hübner, 1799)**, Brown Oak Tortrix

* ***Archips xylosteana* (Linnaeus, 1758)**, Variegated Golden Tortrix

***Archips rosana* (Linnaeus, 1758)**, Rose Tortrix
First recorded by Bradley between 1965 and 1989.

* ***Cacoecimorpha pronubana* (Hübner, 1799)**, Carnation Tortrix

Syndemis musculana (Hübner, 1799)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

* *Ptycholomoides aeriferanus* (Herrich-Schäffer, 1851)

* *Clepsis spectrana* (Treitschke, 1830), Cyclamen Tortrix

* ***Clepsis consimilana* (Hübner, 1817)**

***Ephiphyas postvittana* (Walker, 1863)**, Light Brown Apple Moth
First recorded 18.v.1989, becoming very common from 1998.

Adoxophyes orana (Fischer von Röslerstamm, 1834)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

* *Ptycholoma lecheana* (Linnaeus, 1758)

Lozotaeniodes formosanus (Geyer, 1830)
Recorded 27.vii.1981.

* *Capua vulgana* (Frölich, 1828)

***Ditula angustiorana* (Haworth, 1811)**, Red-barred Tortrix
First recorded 1.vii.1968, common in June and July.

* ***Pseudargyrotoza conwagana* (Fabricius, 1775)**

* *Cnephasia stephensiana* (Doubleday, 1849), Grey Tortrix

* ***Cnephasia asseclana* (Denis & Schiffermüller, 1775)**, Flax Tortrix

* *Cnephasia pasiuana* (Hübner, 1799)
The only Middlesex record. Recorded 26.vi.1964 confirmed by dissection.

* *Cnephasia incertana* (Treitschke, 1835), Light Grey Tortrix

Eana osseana (Scopoli, 1763)
Recorded 17.vii.1967. First Middlesex record.

Eana incanana (Stephens, 1852).
Recorded 24.vii.1972.

* ***Aleimma loeflingiana* (Linnaeus, 1758)**

* ***Tortrix viridana* (Linnaeus, 1758)**, Green Oak Tortrix
Common in June and July.

* ***Acleris forsskaleana* (Linnaeus, 1758)**
Very common in June and July.

Acleris laterana (Fabricius, 1794)
Recorded 5.x.1979.

* ***Acleris sparsana* (Denis & Schiffermüller, 1775)**

Acleris rhombana (Denis & Schiffermüller, 1775), Rhomboid Tortrix
15.x.1969.

* *Acleris aspersana* (Hübner, 1817)
* *Acleris notana* (Donovan, 1806)
* **_Acleris variegana_ (Denis & Schiffermüller, 1775)**, Garden Rose Tortrix
Acleris cristana (Denis & Schiffermüller, 1775)
First recorded 20.vii.1989 and subsequently 3.viii.1995, 18.ix.1997, 5.viii.1999.
* *Celypha striana* (Denis & Schiffermüller, 1775)
* *Olethrutes lacunana* (Denis & Schiffermüller, 1775)
* *Piniphila bifasciana* (Haworth, 1811)
Hedya pruniana (Hübner, 1799), Plum Tortrix
Recorded 11.vi.1973.
** *Hedya nubiferana* (Haworth, 1811), Marbled Orchard Tortrix
** *Hedya ochroleucana* (Frölich, 1828)
* *Apotomis betuletana* (Haworth, 1811)
Lobesia abscisana (Doubleday, 1849)
First recorded 14.vii.1967.
Lobesia littoralis (Humphreys & Westwood, 1845)
Recorded 17.vii.1989.
* *Bactra lancealana* (Hübner, 1799)
Eudemis profundana (Denis & Schiffermüller, 1775)
First recorded 13.vii.1979.
Ancylis achatana (Denis & Schiffermüller, 1775)
Recorded 1.vii.1966.
* *Ancylis badiana* (Denis & Schiffermüller, 1775)
Epinotia subocellana (Donovan, 1806)
Recorded 25.vii.1983.
* **_Epinotia bilunana_ (Haworth, 1811)**
Epinotia demarniana (Fischer von Röslerstamm, 1840)
Recorded 12.vi.1970.
* **_Epinotia immundana_ (Fischer von Röslerstamm, 1839)**
* **_Epinotia nisella_ (Clerck, 1759)**
Epinotia tenerana (Denis & Schiffermüller, 1775), Nut Bud Moth
Recorded 16.vii.1997.
Epinotia tedella (Clerck, 1759)
Recorded 20.vi.1984.
* **_Epinotia abbreviana_ (Fabricius, 1794)**
* *Epinotia brunnichana* (Linnaeus, 1767)
* *Epinotia solandriana* (Linnaeus, 1758)
* **_Rhopobota naevana_ (Hübner, 1817)**, Holly Tortrix
* **_Zeiraphera isertana_ (Fabricius, 1794)**
(Erroneously listed as *incertana* by Bradley & Mere 1964)
* *Zeiraphera griseana* (Hübner, 1799), Larch Tortrix.
First Middlesex record.
* **_Gypsonoma aceriana_ (Duponchel, 1843)**
* **_Gypsonoma sociana_ (Haworth, 1811)**
* **_Gypsonoma dealbana_ (Frölich, 1828)**
Gypsonoma oppressana (Treitschke, 1835)
First recorded by Bradley between 1965 and 1989 but no further data could be traced.
Gypsonoma minutana (Hübner, 1799)
Recorded 18.vii.1969.
* *Epiblema cynosbatella* (Linnaeus, 1758)
Epiblema uddmanniana (Linnaeus, 1758), Bramble Shoot Moth
First recorded 25.vi.1974.
Epiblema rosaecolana (Doubleday, 1850)
Recorded 3.vii.1973.
* *Epiblema foenella* (Linnaeus, 1758)
* **_Eucosma cana_ (Haworth, 1811)**
* *Eucosma obumbratana* (Lienig & Zeller, 1846)
* **_Spilonota ocellana_ (Denis & Schiffermüller, 1775)**, Bud Moth

Spilonota laricana (Heinemann, 1863)
First recorded 27.vii.1965.

* *Clavigesta purdeyi* (Durrant, 1911), Pine Leaf-mining Moth

* *Rhyacionia pinicolana* (Doubleday, 1849)

* *Rhyacionia pinivorana* (Lienig & Zeller, 1846), Spotted Shoot Moth

* ***Enarmonia formosana* (Scopoli, 1763)**, Cherry-bark Tortrix

Lathronympha strigana (Fabricius, 1775)
First recorded 19.vii.1964.

** *Pammene aurita* Razowski, 1991

* *Pammene regiana* (Zeller. 1849)

Pammene trauniana (Denis & Schiffermüller, 1775)
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

* ***Pammene fasciana* (Linnaeus, 1761)**

Pammene herrichiana (Heinemann, 1854)
Recorded 25.vii.1975.

** *Cydia succedana* (Denis & Schiffermüller, 1775)

* ***Cydia fagiglandana* (Zeller, 1841)**

* ***Cydia splendana* (Hübner, 1799)**

* ***Cydia pomonella* (Linnaeus, 1758)**, Codling Moth
Recorded every year in small numbers.

***Dichrorampha alpinana* (Treitschke, 1830)**
Recorded 8.vi.1995.

* *Dichrorampha simpliciana* (Haworth, 1811)

PYRALIDAE

* ***Chrysoteuchia culmella* (Linnaeus, 1758)**
Common in June and July.

* ***Crambus pascuella* (Linnaeus, 1758)**
Common.

* ***Crambus lathoniellus* (Zincken, 1817)**

* *Crambus perlella* (Scopoli, 1763)

* ***Agriphila straminella* (Denis & Schiffermüller, 1775)**

* ***Agriphila tristella* (Denis & Schiffermüller, 1775)**
Common in June and July.

* *Agriphila inquinatella* (Denis & Schiffermüller, 1775)

* ***Agriphila geniculea* (Haworth, 1811)**
Common in August.

Catoptria pinella (Linnaeus, 1758)
First recorded 22.vii.1970.

* *Pediasia contaminella* (Hübner, 1796)

***Platytes alpinella* (Hübner, 1813)**
Recorded 3.viii.1995, first Middlesex record.

Donacaula forficella (Thunberg, 1794)
Recorded 18.vii.1969.

* *Donacaula mucronellus* (Denis & Schiffermüller, 1775)

Scoparia subfusca (Haworth, 1811)
Recorded 18.v.1989.

* ***Scoparia pyralella* (Denis & Schiffermüller, 1775)**

* *Scoparia ambigualis* (Treitschke, 1829)

* ***Eudonia truncicolella* (Stainton, 1849)**

***Eudonia angustea* (Curtis, 1827)**
Recorded 13.ix.2001

* ***Eudonia mercurella* (Linnaeus, 1758)**
Very common from June-August.

* *Acentria ephemerella* (Denis & Schiffermüller, 1775), Water Veneer

* *Elophila nymphaeata* (Linnaeus, 1758), Brown China-mark

Cataclysta lemnata (Linnaeus, 1758), Small China-mark
Recorded 5.viii.1987.

* ***Evergestis forficalis* (Linnaeus, 1758)**, Garden Pebble
Evergestis extimalis (Scopoli, 1763)
First recorded 10.viii.1981.

* ***Pyrausta aurata* (Scopoli, 1763)**
Pyrausta purpuralis (Linnaeus, 1758)
Recorded 21.vii.1982.

** ***Sitochroa verticalis* (Linnaeus, 1758)**

* ***Ostrinia nubilalis* (Hübner, 1796)**, European Corn-borer

* *Eurrhypara hortulata* (Linnaeus, 1758), Small Magpie
***Phlyctaenia coronata* (Hufnagel, 1767)**
First recorded 4.vii.1969.

* *Udea lutealis* (Hübner, 1809)
***Udea olivalis* (Denis & Schiffermüller, 1775)**
Recorded 15.vi.1995.

* *Udea ferrugalis* (Hübner, 1796), Rusty-dot Pearl.

* ***Nomophila noctuella* (Denis & Schiffermüller, 1775)**, Rush Veneer
This migrant occasionally recorded in large numbers.
Maruca vitrata (Fabricius, 1787), Mung Moth
Recorded 2.vii.1992.

* ***Pleuroptya ruralis* (Scopoli, 1763)**, Mother of Pearl

* ***Hypsopygia costalis* (Fabricius, 1775)**, Gold Fringe or Gold Triangle
Very common from June-August.
***Orthopygia glaucinalis* (Linnaeus, 1758)**
Recorded 20.vii.1995.

* *Aglossa pinguinalis* (Linnaeus, 1758), Large Tabby

* ***Endotricha flammealis* (Denis & Schiffermüller, 1775)**
Frequent from June-August
***Achroia grisella* (Fabricius, 1794)**, Lesser Wax Moth
First recorded 17.vii.1989.

* ***Aphomia sociella* (Linnaeus, 1758)**, Bee Moth
Frequent in June and July.

* ***Conobathra repandana* (Fabricius, 1798)**
Recorded incorrectly as *tumidana* (Denis & Schiffermüller, 1775) by Bradley & Mere, 1964.
***Trachycera suavella* (Zincken, 1818)**
Recorded 20.vii.1995.
***Trachycera advenella* (Zincken, 1818)**
First recorded 30.vii.1975.

* *Pempelia formosa* (Haworth, 1811)

** *Pyla fusca* (Haworth, 1811)

* ***Phycita roborella* (Denis & Schiffermüller, 1775)**

* *Myelois circumvoluta* (Geoffroy, 1785), Thistle Ermine
Apomyelois ceratoniae (Zeller, 1839), Locust Bean Moth
Recorded 6.vi.1980.
***Eccopisa effractella* (Zeller, 1848)**
Recorded 13.vii.1995 – new to Britain (Agassiz, 1996).
Ancylosis oblitella (Zeller, 1848)
Recorded 5.viii.1976.
Euzophera cinerosella (Zeller, 1839)
Recorded 30.vi.1970.

* ***Euzophera pinguis* (Haworth, 1811)**
Ephestia elutella (Hübner, 1796), Cacao Moth
Recorded 7.vii.1969
***Ephestia parasitella* (Staudinger, 1859)**
First recorded by Bradley between 1965 and 1989.
***Plodia interpunctella* (Hübner, 1813)**, Indian Meal Moth
Recorded 12.viii.1999.
Homoeosoma sinuella (Fabricius, 1794)
First recorded 23.vi.1976.

* *Phycitodes binaevella* (Hübner, 1813)
* *Phycitodes saxicola* (Vaughan, 1870)

PTEROPHORIDAE

* *Amblyptilia acanthadactyla* (Hübner, 1813)
New to Middlesex list.

Platyptilia ochrodactyla (Denis & Schiffermüller, 1775)
First recorded 9.viii.1967

Stenoptilia bipunctidactyla (Scopoli, 1763)
Recorded 11.ix.1975, first Middlesex record.

* *Pterophorus pentadactyla* (Linnaeus, 1758), White Plume Moth

***Emmelina monodactyla* (Linnaeus, 1758)**
First recorded 10.x.1975.

HESPERIIDAE

Ochlodes faunus (Turati, 1905), Large Skipper
Recorded 5.vii.1979.

Erynnis tages (Linnaeus, 1758), Dingy Skipper
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

PIERIDAE

Colias croceus (Geoffroy, 1785), Clouded Yellow
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

Gonepteryx rhamni (Linnaeus, 1758), Brimstone
First recorded 18.ix.1968.

* ***Pieris brassicae* (Linnaeus, 1758)**, Large White

* ***Pieris rapae* (Linnaeus, 1758)**, Small White

Pieris napi (Linnaeus, 1758), Green-veined White
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

Anthocharis cardamines (Linnaeus, 1758), Orange-tip
Recorded 13.v.1980.

LYCAENIDAE

Neozephyrus quercus (Linnaeus, 1758), Purple Hairstreak
Recorded 25.vii.1983.

Lycaena phlaeas (Linnaeus, 1761), Small Copper
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

Lycaena dispar (Haworth, 1803), Large Copper
3.viii.1977, trial release; see discussion.

Polyommatus icarus (Rottemburg, 1775), Common Blue
Recorded 22.viii.1983.

* ***Celastrina argiolus* (Linnaeus, 1758)**, Holly Blue
Became very common in 1989 and has maintained good numbers since.

NYMPHALIDAE

* ***Vanessa atalanta* (Linnaeus, 1758)**, Red Admiral
Several observations on *Buddleja* and in the herbaceous border.

***Cynthia cardui* (Linnaeus, 1758)**, Painted Lady
First recorded 12.ix.1966.

* ***Aglais urticae* (Linnaeus, 1758)**, Small Tortoiseshell
Several observations on *Buddleja* and in the herbaceous border.

***Inachis io* (Linnaeus, 1758)**, Peacock
First recorded 6.vi.1975.

***Polygonia c-album* (Linnaeus, 1758)**, Comma
First recorded 13.ix.1976.

***Pararge aegeria* (Linnaeus, 1758)**, Speckled Wood
First recorded 31.ix.1972, now very common in wooded areas of the garden.

Lasiommata megera (Linnaeus, 1767), Wall
Seen on two occasions by Bradley in the 1970s but no precise data could be traced.

***Pyronia tithonus* (Linnaeus, 1771)**, Hedge Brown or Gatekeeper
One specimen observed 15.viii.91 on Ragwort flowers on The Mound.

Maniola jurtina (Linnaeus, 1758), Meadow Brown
Seen occasionally by Bradley between 1965 and 19819 but no precise data could be traced.

Coenonympha pamphilus (Linnaeus, 1758), Small Heath
Seen rarely by Bradley between 1965 and 1989, but no precise data could be traced.

DREPANIDAE

Falcaria lacertinaria (Linnaeus, 1758), Scalloped Hook-tip
Recorded 27.vii.1967.

* ***Watsonalla binaria* (Hufnagel, 1767)**, Oak Hook-tip

* *Cilix glaucata* (Scopoli, 1763), Chinese Character

THYATIRIDAE

* ***Tethea ocularis* (Linnaeus, 1767)**, Figure of Eighty
Numerous records since 1995.

GEOMETRIDAE

***Alsophila aescularia* (Denis & Schiffermüller, 1775)**, March Moth
Recorded 13.iii.1997.

***Hemithea aestivaria* (Hübner, 1799)**, Common Emerald
First recorded 2.vii.1975.

Cyclophora punctaria (Linnaeus, 1758), Maiden's Blush,
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

* *Timandra comae* (Schmidt, 1931), Blood-vein

* *Scopula marginepunctata* (Goeze, 1781), Mullein Wave

***Idaea rusticata* (Denis & Schiffermüller, 1775)**, Least Carpet
Recorded 31.vii.1981.

* ***Idaea seriata* (Schrank, 1802)**, Small Dusty Wave

* ***Idaea aversata* (Linnaeus, 1758)**, Riband Wave
Very common in June and July.

Idaea straminata (Borkhausen, 1794), Plain Wave
Recorded by Bradley in 1971 (Plant, 1993:35).

Rhodometra sacraria (Linnaeus, 1767), Vestal
Recorded 5-10.v.1983.

* *Orthonama obstipata* (Fabricius, 1794), Gem

* *Xanthorhoe spadicearia* (Denis & Schiffermüller, 1775), Red Twin-spot Carpet

* *Xanthorhoe ferrugata* (Clerck, 1759), Dark-barred Twin-spot Carpet

** *Xanthorhoe montanata* (Denis & Schiffermüller, 1775), Silver-ground Carpet

* ***Xanthorhoe fluctuata* (Linnaeus, 1758)**, Garden Carpet
Common.

* *Epirrhoe alternata* (Müller, 1764), Common Carpet

* *Camptogramma bilineata* (Linnaeus, 1758), Yellow Shell

* *Pelurga comitata* (Linnaeus, 1758), Dark Spinach

***Eulithis prunata* (Linnaeus, 1758)**, Phoenix
Recorded 26.vii.2001.

* *Eulithis mellinata* (Fabricius, 1787), Spinach

* *Ecliptopera silaceata* (Denis & Schiffermüller, 1775), Small Phoenix

***Chloroclysta siterata* (Hufnagel, 1767)**, Red-green Carpet
Recorded 1.x1998. An extremely scarce and local resident in London (Plant, 1993), though now undergoing an expansion of range (Plant, 1999).

***Chloroclysta citrata* (Linnaeus, 1761)**, Dark Marbled Carpet
Recorded 13.vi.1996. Plant (1993) records this as a widespread but very local resident in London.

* ***Chloroclysta truncata* (Hufnagel, 1767)**, Common Marbled Carpet,
Recorded every year, usually dark forms.

Plemyria rubiginata (Denis & Schiffermüller, 1775), Blue-bordered Carpet
Recorded 13.vii.1970.

* ***Thera obeliscata* (Hübner, 1787)**, Grey Pine Carpet
Numerous records since 1995.

* ***Hydriomena furcata* (Thunberg, 1784)**, July Highflyer

Hydriomena impluviata (Denis & Schiffermüller, 1775), May Highflyer
Recorded 16.vi.1966.

** *Triphosa dubitata* (Linnaeus, 1758), Tissue

** *Philereme vetulata* (Denis & Schiffermüller, 1775), Brown Scallop

Philereme transversata (Hufnagel, 1767), Dark Umber
Recorded 3.vii.1973.

Euphyia biangulata (Haworth, 1809), Cloaked Carpet,
Recorded by Bradley between 1965 and 1989 but no further data could be traced. First Middlesex record.

Euphyia unangulata (Haworth, 1809), Sharp-angled Carpet
Recorded 22.vii.1970.

* *Epirrita dilutata* (Denis & Schiffermüller, 1775)
November Moth

* *Operophtera brumata* (Linnaeus, 1758), Winter Moth

* *Perizoma alchemillata* (Linnaeus, 1758), Small Rivulet

Eupithecia inturbata (Hübner, 1817), Maple Pug
Recorded 8.viii.1975.

* ***Eupithecia linariata* (Denis & Schiffermüller, 1775)**, Toadflax Pug

* *Eupithecia pulchellata* Stephens, 1831, Foxglove Pug

***Eupithecia exiguata* (Hübner, 1813)**, Mottled Pug
First recorded 20.v.1982.

* ***Eupithecia centaureata* (Denis & Schiffermüller, 1775)**, Lime-speck Pug

Eupithecia intricata (Zetterstedt, 1839), Freyer's Pug
Recorded 7.vi.1984.

Eupithecia absinthiata (Clerck, 1759), Wormwood Pug
Recorded 8.vii.1966.

* ***Eupithecia vulgata* (Haworth, 1809)**, Common Pug

* *Eupithecia icterata* (Villers, 1789), Tawny Speckled Pug

* *Eupithecia succenturiata* (Linnaeus, 1758), Bordered Pug

Eupithecia millefoliata Rössler, 1866, Yarrow Pug,
Recorded by Bradley in 1974 (Plant, 1993).

Eupithecia simpliciata (Haworth, 1809), Plain Pug
Recorded 26.vii.1974.

Eupithecia nanata (Hübner, 1813), Narrow-winged Pug
Recorded 13.vii.1973.

Eupithecia innotata f. *fraxinata* Crewe, 1863, Ash Pug
Recorded 8.vi.1973.

* *Eupithecia abbreviata* Stephens, 1831, Brindled Pug

Eupithecia dodoneata Guenée, 1857, Oak-tree Pug
Recorded 21.v.1973.

* *Eupithecia lariciata* (Freyer, 1842), Larch Pug

* ***Pasiphila rectangulata* (Linnaeus, 1758)**, Green Pug
Common, usually melanic.

* ***Gymnoscelis rufifasciata* (Haworth, 1809)**, Double-striped Pug
Quite common.

Chesias legatella (Denis & Schiffermüller, 1775), Streak
Recorded 13.x1967. A very local and uncommon resident in London (Plant 1993).

Aplocera plagiata (Linnaeus, 1758), Treble-bar
Recorded 23.ix.1981.

* ***Aplocera efformata* (Guenée, 1857)**, Lesser Treble-bar

* *Acasis viretata* (Hübner, 1799), Yellow-barred Brindle

* *Abraxas grossulariata* (Linnaeus, 1758), Magpie

Macaria liturata (Clerck, 1759), Tawny-barred Angle
Recorded 21.v.1985.

* *Macaria wauaria* (Linnaeus, 1758), V-moth

** *Chiasmia clathrata* (Linnaeus, 1758), Latticed Heath

Petrophora chlorosata (Scopoli, 1763), Brown Silver-line
Recorded 7.vi.1968.

* ***Opisthograptis luteolata* (Linnaeus, 1758)**, Brimstone Moth
A few specimens every year.

Apeira syringaria (Linnaeus, 1758), Lilac Beauty
Recorded 29.vi.1989.

* *Ennomos quercinaria* (Hufnagel, 1767), August Thorn

***Ennomos alniaria* (Linnaeus, 1758)**, Canary-shouldered Thorn
Recorded 8.viii.1996.

* *Ennomos fuscantaria* (Haworth, 1809), Dusky Thorn

* *Odontopera bidentata* (Clerck, 1759), Scalloped Hazel

* ***Crocallis elinguaria* (Linnaeus, 1758)**, Scalloped Oak

* ***Ourapteryx sambucaria* (Linnaeus, 1758)**, Swallow-tailed Moth

* ***Colotois pennaria* (Linnaeus, 1761)**, Feathered Thorn

* ***Lycia hirtaria* (Clerck, 1759)**, Brindled Beauty

* ***Biston betularia* (Linnaeus, 1758)**, Peppered Moth

* *Agriopis aurantiaria* (Hübner, 1799), Scarce Umber

** *Agriopis marginaria* (Fabricius, 1777), Dotted Border

***Erannis defoliaria* (Clerck, 1759)**, Mottled Umber
First recorded 21.x.1966.

Menophra abruptaria (Thunberg, 1792), Waved Umber
First recorded 7.vi.1972.

* ***Peribatodes rhomboidaria* (Denis & Schiffermüller, 1775)**, Willow Beauty
Very common in most years.

***Alcis repandata* (Linnaeus, 1758)**, Mottled Beauty
Recorded 6.vii.2001.

Aethalura punctulata (Denis & Schiffermüller, 1775), Grey Birch
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

* *Cabera pusaria* (Linnaeus, 1758), Common White Wave

Cabera exanthemata (Scopoli, 1763), Common Wave
Recorded 8.vi.1970.

Lomographa bimaculata (Fabricius, 1775), White-pinion Spotted
Recorded 20.v.1982.

***Lomographa temerata* (Denis & Schiffermüller, 1775)**, Clouded Silver
First recorded 16.vi.1984.

***Campaea margaritata* (Linnaeus, 1767)**, Light Emerald
First recorded 27.vi.1973, now a few specimens every year.

***Hylaea fasciaria* (Linnaeus, 1758)**, Barred Red
Recorded 13.vii.2001.

SPHINGIDAE

* *Sphinx ligustri* (Linnaeus, 1758), Privet Hawk-moth

* ***Mimas tiliae* (Linnaeus, 1758)**, Lime Hawk-moth
A few every year.

Smerinthus ocellata (Linnaeus, 1758), Eyed Hawk-moth
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

* ***Laothoe populi* (Linnaeus, 1758)**, Poplar Hawk-moth
A few every year.

Macroglossum stellatarum (Linnaeus, 1758), Humming-bird Hawk-moth
Seen by Bradley and the palace gardeners on several occasions between 1965 and 1989 but no precise data could be traced.

Deilephila elpenor (Linnaeus, 1758), Elephant Hawk-moth
Recorded 16.vi.1970.

NOTODONTIDAE

Cerura vinula (Linnaeus, 1758), Puss Moth
Recorded by Bradley between 1965 and 1989, but no further data could be traced.

***Furcula bifida* (Brahm, 1787)**, Poplar Kitten
First recorded 9.vii.1971.

***Pheosia tremula* (Clerck, 1759)**, Swallow Prominent
First recorded 7.vii.1967.

* *Phalera bucephala* (Linnaeus, 1758), Buff-tip

LYMANTRIIDAE

* ***Orgyia antiqua* (Linnaeus, 1758)**, Vapourer

***Euproctis chrysorrhoea* (Linnaeus, 1758)**, Brown-tail
First recorded 14.vii.1967 (Bradley,1984), now a few specimens recorded each year.

* ***Leucoma salicis* (Linnaeus, 1758)**, White Satin Moth

***Lymantria monacha* (Linnaeus, 1758)**, Black Arches
Recorded 8.viii.1996. A noteworthy record at the time, although this species subsequently appeared in a number of garden light traps in London during 1997 and 1998 (Plant, 1999).

ARCTIIDAE

** *Eilema complana* (Linnaeus 1758), Scarce Footman

***Eilema depressa* (Esper, 1787)**, Buff Footman
Recorded 2.viii.2001.

* *Eilema lurideola* (Zincken, 1817), Common Footman

* ***Arctia caja* (Linnaeus, 1758)**, Garden Tiger

* ***Spilosoma lubricipeda* (Linnaeus, 1758)**, White Ermine

* *Spilosoma luteum* (Hufnagel, 1766), Buff Ermine

* *Diaphora mendica* (Clerck, 1759), Muslin Moth

* *Phragmatobia fuliginosa* (Linnaeus, 1758), Ruby Tiger

* *Tyria jacobaeae* (Linnaeus, 1758), Cinnabar

NOLIDAE

Nola cucullatella (Linnaeus, 1758), Short-cloaked Moth
First recorded 4.vii.1969.

NOCTUIDAE

* ***Agrotis segetum* (Denis & Schiffermüller, 1775)**, Turnip Moth
Recorded every year.

***Agrotis clavis* (Hufnagel, 1766)**, Heart & Club
Recorded 28.vii.1995.

* ***Agrotis exclamationis* (Linnaeus, 1758)**, Heart & Dart
Very common.

* ***Agrotis ipsilon* (Hufnagel, 1766)**, Dark Sword-grass

* ***Agrotis puta* (Hübner, 1803)**, Shuttle-shaped Dart
Common.

* *Axylia putris* (Linnaeus, 1761), Flame

* ***Ochropleura plecta* (Linnaeus, 1761)**, Flame Shoulder

* ***Noctua pronuba* (Linnaeus, 1758)**, Large Yellow Underwing
Very common.

* ***Noctua comes* (Hübner, 1813)**, Lesser Yellow Underwing
Common.

* ***Noctua fimbriata* (Schreber, 1759)**, Broad-bordered Yellow Underwing

* ***Noctua janthe* (Borkhausen, 1792)**, Lesser Broad-bordered Yellow Underwing
Common

Noctua interjecta (Hübner, 1803), Least Yellow Underwing
Recorded 16.viii.1974.

* *Graphiphora augur* (Fabricius, 1775), Double Dart

Eugnorisma glareosa (Esper, 1788), Autumnal Rustic
Recorded 19.ix.1985. A very local species in London (Plant, 1993).

Lycophotia porphyrea (Denis & Schiffermüller, 1775), True Lover's Knot
First recorded 23.vii.1969.

* *Peridroma saucia* (Hübner, 1808), Pearly Underwing

* ***Diarsia rubi* (Vieweg, 1790)**, Small Square-spot
Common.

* ***Xestia c-nigrum* (Linnaeus, 1758)**, Setaceous Hebrew Character
A few specimens every year.

***Xestia triangulum* (Hufnagel, 1766)**, Double Square-spot
Recorded 18.vii.1996.

* ***Xestia xanthographa* (Denis & Schiffermüller, 1775)**, Square-spot Rustic
Common every year.

* *Discestra trifolii* (Hufnagel, 1766), Nutmeg

Hada plebeja (Linnaeus, 1761), Shears
First recorded 1.vii.1968.

Polia nebulosa (Hufnagel, 1766), Grey Arches
Recorded 9.vii.1992.

* ***Mamestra brassicae* (Linnaeus, 1758)**, Cabbage Moth

* *Melanchra persicariae* (Linnaeus, 1761), Dot Moth

* *Melanchra pisi* (Linnaeus, 1758), Broom Moth

* *Lacanobia thalassina* (Hufnagel, 1766), Pale-shouldered Brocade

* ***Lacanobia oleracea* (Linnaeus, 1758)**, Bright-line Brown-eye
A few every year.

* ***Hadena rivularis* (Fabricius, 1775)**, Campion

* *Hadena confusa* (Hufnagel, 1766), Marbled Coronet

* ***Hadena bicruris* (Hufnagel, 1766)**, Lychnis

* *Cerapteryx graminis* (Linnaeus, 1758), Antler Moth

Tholera cespitis (Denis & Schiffermüller, 1775), Hedge Rustic
Recorded by Bradley between 1965 and 1989 but no further data could be traced.

***Orthosia cruda* (Denis & Schiffermüller, 1775)**, Small Quaker
First recorded 18.iv1996.

* ***Orthosia cerasi* (Fabricius, 1775)**, Common Quaker

* ***Orthosia incerta* (Hufnagel, 1766)**, Clouded Drab
Common.

***Orthosia munda* (Denis & Schiffermüller, 1775)**, Twin-spotted Quaker
First recorded by Bradley between 1965 and 1989.

* ***Orthosia gothica* (Linnaeus, 1758)**, Hebrew Character
Common.

* *Mythimna conigera* (Denis & Schiffermüller, 1775), Brown-line Bright-eye

* ***Mythimna ferrago* (Fabricius, 1787)**, Clay
A few every year.

* ***Mythimna impura* (Hübner, 1808)**, Smoky Wainscot
A few every year.

* ***Mythimna pallens* (Linnaeus, 1758)**, Common Wainscot
A few every year.

** *Mythimna comma* (Linnaeus, 1761), Shoulder-striped Wainscot

* *Cucullia absinthii* (Linnaeus, 1761), Wormwood

***Shargacucullia verbasci* (Linnaeus, 1758)**, Mullein
Larva noted on *Verbascum* in glasshouse in 1999, date not recorded. According to Plant (1993) this moth is rather local in London and is mainly confined to more rural areas.

* *Brachylomia viminalis* (Fabricius, 1777), Minor Shoulder-knot

Aporophyla lutulenta (Denis & Schiffermüller, 1775), Deep-brown Dart
Recorded 6.x.1978.

***Aporophyla nigra* (Haworth, 1809)**, Black Rustic
First recorded 4.x.1968.

Lithophane ornitopus (Hufnagel, 1766), Grey Shoulder-knot
Recorded 19.x.1989.

***Lithophane leautieri* (Boisduval, 1829)**, Blair's Shoulder-knot or Stone Pinion
First recorded 19.x.1989.

***Xylocampa areola* (Esper, 1789)**, Early Grey
First recorded 15.iv.1981.

** ***Eupsilia transversa* (Hufnagel, 1766)**, Satellite

** *Conistra vaccinii* (Linnaeus, 1761), Chestnut

* ***Agrochola circellaris* (Hufnagel, 1766)**, Brick

Agrochola lota **(Clerck, 1759)**, Red-line Quaker
First recorded 8.x1998.

Agrochola litura **(Linnaeus, 1761)**, Brown-spot Pinion
First recorded 19.ix.1986.

* *Agrochola lychnidis* (Denis & Schiffermüller, 1775), Beaded Chestnut

Atethmia centrago **(Haworth, 1809)**, Centre-barred Sallow
First recorded 18.ix1997.

Omphaloscelis lunosa **(Haworth, 1809)**, Lunar Underwing
First recorded 19.ix.1985.

Xanthia icteritia (Hufnagel, 1766), Sallow
Recorded 10.ix.1992

* ***Acronicta megacephala*** **(Denis & Schiffermüller, 1775)**, Poplar Grey

* ***Acronicta aceris*** **(Linnaeus, 1758)**, Sycamore

Acronicta leporina (Linnaeus, 1758), Miller
Recorded 22.vi.1989.

* ***Acronicta psi*** **(Linnaeus, 1758)**, Grey Dagger
Several records.

* ***Acronicta rumicis*** **(Linnaeus, 1758)**, Knot Grass

* ***Cryphia domestica*** **(Hufnagel, 1766)**, Marbled Beauty
Now common every year.

* ***Amphipyra pyramidea*** **(Linnaeus, 1758)**, Copper Underwing
Quite common every year.

Amphipyra berbera **Rungs, 1949**, Svensson's Copper Underwing
First recorded 19.ix.1968.

* *Amphipyra tragopogonis* (Clerck, 1759), Mouse Moth

* ***Mormo maura*** **(Linnaeus, 1758)**, Old Lady
Common every year at m.v.; also found aestivating in the ice house and in the former hen house by The Lake.

* ***Dypterygia scabriuscula*** **(Linnaeus, 1758)**, Bird's Wing

* ***Thalpophila matura*** **(Hufnagel, 1766)**, Straw Underwing

* *Euplexia lucipara* (Linnaeus, 1758), Small Angle Shades

* ***Phlogophora meticulosa*** **(Linnaeus, 1758)**, Angle Shades
A few every year.

Ipimorpha subtusa **(Denis & Schiffermüller, 1775)**, Olive
First recorded 4.viii.1987.

* ***Parastichtis suspecta*** **(Hübner, 1817)**, Suspected
Several records in July. A very local and uncommon London resident (Plant, 1993).

* *Parastichtis ypsillon* (Denis & Schiffermüller, 1775), Dingy Shears

* *Cosmia affinis* (Linnaeus, 1767), Lesser-spotted Pinion

* ***Cosmia trapezina*** **(Linnaeus, 1758)**, Dun-bar
Very common every year, sometimes occurring in large numbers.

* ***Apamea monoglypha*** **(Hufnagel, 1766)**, Dark Arches
Very common every year.

* ***Apamea lithoxylaea*** **(Denis & Schiffermüller, 1775)**, Light Arches

* *Apamea remissa* (Hübner, 1809), Dusky Brocade

** *Apamea anceps* (Denis & Schiffermüller, 1775), Large Nutmeg

* *Apamea sordens* (Hufnagel, 1766), Rustic Shoulder-knot

Apamea ophiogramma (Esper, 1793), Double Lobed
Recorded 22.vii.1970.

* ***Oligia strigilis*** **(Linnaeus, 1758)**, Marbled Minor

* ***Oligia latruncula*** **(Denis & Schiffermüller, 1775)**, Tawny Marbled Minor
Dark forms very common.

* *Oligia fasciuncula* (Haworth, 1809), Middle-barred Minor

* ***Mesoligia furuncula*** **(Denis & Schiffermüller, 1775)**, Cloaked Minor

* *Mesoligia literosa* (Haworth, 1809), Rosy Minor

* ***Mesapamea secalis*** **(Linnaeus, 1758)**, Common Rustic
Common.

Mesapamea didyma (Esper, 1788), Lesser Common Rustic
Recorded 3.viii.2001 (checked by dissection), but probably overlooked earlier.

* *Photedes minima* (Haworth, 1809), Small Dotted Buff

* *Chortodes pygmina* (Haworth, 1809), Small Wainscot

* **Luperina testacea (Denis & Schiffermüller, 1775)**, Flounced Rustic
Common.

* *Amphipoea oculea* (Linnaeus, 1761), Ear Moth

* *Hydraecia micacea* (Esper, 1789), Rosy Rustic

* *Celaena leucostigma* (Hübner, 1808), Crescent

* *Coenobia rufa* (Haworth, 1809), Small Rufous

Charanyca trigrammica (Hufnagel, 1766), Treble Lines
Recorded 1.vi.1995.

* **Hoplodrina alsines (Brahm, 1791)**, Uncertain

* **Hoplodrina blanda (Denis & Schiffermüller, 1775)**, Rustic

* **Hoplodrina ambigua (Denis & Schiffermüller, 1775)**, Vine's Rustic

* *Caradrina morpheus* (Hufnagel, 1766), Mottled Rustic

* **Paradrina clavipalpis (Scopoli, 1763)**, Pale Mottled Willow
Very common every year.

Protodeltote pygarga (Hufnagel, 1766), Marbled White Spot
Recorded 15.vi.1989.

Earias clorana (Linnaeus, 1761), Cream-bordered Green Pea
Recorded 7.vi.1968. An extremely local London resident (Plant, 1993).

* *Earias biplaga* (Walker, 1866), Spiny Bollworm
Recorded vii.1964 as new to Britain (Bradley & Mere, 1964).

Bena bicolorana (Fuessly, 1775), Scarce Silver-lines
First recorded 26.vi.1997.

Nycteola revayana (Scopoli, 1772), Oak Nycteoline
First recorded 9.vii.1986.

* *Diachrysia chrysitis* (Linnaeus, 1758), Burnished Brass

Polychrysia moneta (Fabricius, 1787), Golden Plusia
Recorded 6.vii.1973.

* **Autographa gamma (Linnaeus, 1758)**, Silver Y
Recorded every year, this common migrant sometimes occurs in large numbers.

* *Autographa pulchrina* (Haworth, 1809), Beautiful Golden Y

* *Abrostola triplasia* (Linnaeus, 1758), Dark Spectacle.
Extremely local and rare in London (Plant, 1993).

* **Abrostola tripartita (Hufnagel, 1766)**, Spectacle

* **Catocala nupta (Linnaeus, 1767)**, Red Underwing

Lygephila pastinum (Treitschke, 1826), Blackneck
Recorded 12.vi.1966.

* **Scoliopteryx libatrix (Linnaeus, 1758)**, Herald
At m.v. and also found aestivating in the ice house.

Laspeyria flexula (Denis & Schiffermüller, 1775), Beautiful Hook-tip
Recorded 28.vii.1978.

Rivula sericealis (Scopoli, 1763), Straw Dot
First recorded 9.vii.1971.

* *Hypena proboscidalis* (Linnaeus, 1758), Snout

Schrankia costaestrigalis (Stephens, 1834), Pinion-streaked Snout
Recorded 6.vii.2000, the first Middlesex record.

Zanclognatha tarsipennalis (Treitschke, 1835), Fan-foot
Recorded 19.viii.1968.

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PLATE I. Buckingham Palace Garden, London. Semi-natural vegetation by The Lake at Mudhole provides an important source of larval food plants for Lepidoptera and other insects.

Photographed © by Mark Lane

The caddisflies (Trichoptera) of Buckingham Palace Garden

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Abstract

Light-trap catches of adult Trichoptera have resulted in a total of 20 species being recorded from Buckingham Palace Garden, of which seven have been added since the original survey. One species, *Ceraclea senilis* (Burmeister), is Nationally Notable in the UK. Comparisons of the fauna are made with species known from the London area.

Introduction

With 198 species recorded from the British Isles (Barnard, 1999) the caddisflies are one of our largest groups of freshwater insects, and their often restricted ecological requirements, coupled with the fact that almost any water-body can harbour at least a few species, means that they are useful environmental indicators. However, most of the species found in the London area are common and widespread throughout the UK, and those recorded in Buckingham Palace Garden are no exception, apart from *Ceraclea senilis* which is a Nationally Notable species (Wallace, 1991).

The original survey (Richards, 1964a) produced a fairly typical list of thirteen species of adult Trichoptera caught in the light-trap, with two species of caddis larvae found in the lake, only one of which could be identified with any certainty (Evans *et al.*, 1964). However, Dr J. D. Bradley continued to run a mercury-vapour light-trap through the late 1960s and 1970s in the Garden, principally to catch Lepidoptera (see Bradley & Mere 1966) and a total of 78 Trichoptera were caught during this period, all of which were deposited in The Natural History Museum, London. These represented thirteen species, seven of which were additions to the original list. Some of these were misidentified by an earlier worker, but the records had not been published, so the opportunity has been taken to re-identify all this material and to present the records here. During the most recent collecting activity in 1995 twelve specimens were caught in the light-trap on The Mound, with two more in the Malaise trap, but no new species were added to the list.

Although there are few published records of this group from central London, there is much relevant material in the collections of The Natural History Museum, and comparisons can also be made with specimens captured at light in the museum's Wildlife Garden in South Kensington since 1995. Recently published studies on the freshwater faunas in outer London areas include one on the New River (Smith 1989). It should be noted that the list of species for the London area compiled by Richards (1964b) is rather strange: even allowing for changes in nomenclature and possible misidentifications it is not a typical list for south-east England, and some of the species and habitats are poorly matched.

Collecting Methods

As noted above, all the adults collected from the Garden were caught in light-traps, with just two recent specimens of *Tinodes waeneri* in the Malaise trap. Different collecting methods can give very different pictures of the apparent fauna of an area, and this is particularly true for Trichoptera. Some species are not attracted to light at all, and others show a marked sexual difference in their reaction to light-traps (Crichton 1960); moreover some of the larger Limnephilidae fly considerable distances, up to 1 or 2 km from their emergence site as part of their normal dispersive behaviour (Crichton 1960), and so the regular trapping of a particular species does not necessarily mean that it is breeding in the immediate vicinity. Other species fly very little, and are hard to catch with any normal trapping method, so that hand-netting and individual searching are necessary. It is only the finding of caddis larvae in a body of water that guarantees the presence of a species, and unfortunately the lake in Buckingham Palace Garden has yielded very few specimens.

Discussion

All the species recorded from the Garden are listed below, with individual records of every specimen caught after the original survey. Comparisons are made with known collections from London, especially The Natural History Museum's Wildlife Garden (all specimens identified by the author). An indication of the status of each species is given, using the definitive work by Wallace (1991). The most interesting species found in the Garden is undoubtedly *Ceraclea senilis* to which Wallace gives 'Notable' status, although it is known from several sites in south-east England. Apart from the special status of this species, its larvae feed on freshwater sponges, as do several species of *Ceraclea* though not those of *C. dissimilis*, the other species found in the Garden. So if *C. senilis* really breeds there the presence of sponges in the lake is indicated, and this is also shown by the capture in Bradley's light-trap of several sponge-flies (Neuroptera: Sisyridae), whose larvae are also dependent on freshwater sponges (Kirby 1981). The larva of '*Leptocerus* sp.' recorded in the original survey (Evans *et al.* 1964) was probably a specimen of *Athripsodes* or *Ceraclea*, but in the absence of any voucher specimens it is impossible to say which.

The sex ratios of specimens caught in the light-trap are also of interest, although the numbers of most species are too low to be analysed meaningfully. Of the 21 specimens of *Mystacides longicornis*, 12 are males, and this corresponds with the usual slight preponderance of males in light-trap catches (Crichton 1960). However, this species forms large mating swarms, and the accidental capture of part of a large swarm can strongly influence the recorded sex ratio. All except three of the 27 specimens of *Tinodes waeneri* were males, and this is very unusual. In light-trap catches this species usually shows a proportion of males of at most around 70% whether caught in a mercury-vapour trap (Crichton 1965) or in Rothamsted traps (Crichton & Fisher 1982).

With the total numbers collected being small, and with the uncertainty about which species actually breed in the lake it is not possible to make predictions about any further species one might expect to see recorded, nor to make any meaningful comparison with the original survey. Twenty species is not a particularly low total number for such an inner city site, and any further additions to the list are likely to be chance captures of dispersing individuals.

An annotated list of Trichoptera recorded in Buckingham Palace Garden

In the following list [1964] means that the species was recorded in the first survey, but the exact year of capture is not known. All specimens were caught in light-traps except where indicated. The Natural History Museum is abbreviated to NHM, and the nomenclature follows Barnard (1985). Most records relate to light-trapped material, caught between the two main surveys. Therefore the list has been exempted from the editorial requirement for the use of asterisks to denote species recorded as new in the 1995 to 1997 survey and the use of round brackets to indicate species not refound since the 1960s survey.

TRICHOPTERA

HYDROPTILIDAE

Agraylea multipunctata Curtis, 1834

vii [1964]; 1♂, 23.vi.1975. Common in weedy ponds and lakes, recorded in the London area, including the NHM Wildlife Garden.

Hydroptila sparsa Curtis, 1834

1♀, 26.vii.1972. Common in southern England, generally in flowing water; recorded in the London area, including the NHM Wildlife Garden.

Orthotrichia costalis (Curtis, 1834)

vii [1964] (as *O. tetensii*); 1♀, 10.vii.1972; 1♀, 14.v.1976; 1♀, 20.v.1979. Local but widespread in still or slow water.

PSYCHOMYIIDAE

Lype phaeopa (Stephens, 1836)

vii, ix [1964]. Common in larger water bodies; recorded from the London area.

Tinodes waeneri (L., 1758)

3♂, 24.v.1972; 2♂, 22.vi.1972; 3♂, 14.vii.1972; 2♂, 19.vii.1972; 1♂, 24.vii.1972; 3♂, 21.v.1973; 1♂, 15.viii.1973; 1♂, 17.vi.1974; 1♂, 25.vi.1974; 1♂, 16.viii.1974; 3♂, 6.vi.1975; 1♂, 21.vii.1975; 1♂, 11.ix.1975; 1♂, 9.vi.1976; 1♂, 7.x.1977; 1♂, 19.vii.1995; 1♂, 20.vii.1995; 1♂, 17-24.viii.1995 (Malaise trap); 1♂, 1♀, 24.viii.1995; 1♂, 7-22.ix.1995 (Malaise trap); 2♂, 2♀, 22.ix.1995. Common in lakes and slow rivers; known from the Serpentine and the NHM Wildlife Garden, but curiously not recorded in the original Buckingham Palace Garden survey.

POLYCENTROPODIDAE

Cyrnus flavidus McLachlan, 1864

vii [1964]. Common in large ponds and lakes; known from the Serpentine and the NHM Wildlife Garden.

PHRYGANEIDAE

Phryganea bipunctata Retzius, 1783

1♀, 3.vi.1970. Common in weedy ponds and lakes; recorded from the London area.

LIMNEPHILIDAE

Stenophylax permistus McLachlan, 1895

x [1964]. Common in ditches and small streams, but can fly considerable distances from breeding sites; recorded in the London area.

Anabolia nervosa (Curtis, 1834)

1♂, 31.ix.1972; 1♂, 7.x.1977; 1♂, 6.x.1978. Common in rivers, lakes and large ponds; recorded from the London area.

Glyphotaelius pellucidus (Retzius, 1783)

vi, viii [1964]. Common, especially in temporary pools surrounded by deciduous trees, but can fly long distances from breeding sites; recorded from the London area.

Limnephilus affinis Curtis, 1834

vii, ix, x [1964]. Common in temporary water-bodies, especially saltmarshes or waste sites, but the adults fly long distances from breeding sites; recorded from the London area, including the NHM Wildlife Garden.

Limnephilus flavicornis (F., 1787)

1♀, 3.x.1973. Common in many types of water-bodies; recorded from the London area.

Limnephilus marmoratus Curtis, 1834

x [1964]. Common in many types of water-bodies.

LEPTOCERIDAE

Athripsodes cinereus (Curtis, 1834)

1♀, 28.vi.1972; 1♂, 10.vii.1972; 1♀, 14.vii.1972; 2♂, 1♀, 19.vii.1972. Common in still or flowing water with stony or sandy substrates; recorded from Hyde Park.

Ceraclea dissimilis (Stephens, 1836)

1♂, 7.vi.1972; 1♀, 16.vi.1972; 1♀, 22.vi.1972. Common in rivers and lakes; recorded from the London area, including the NHM Wildlife Garden.

Ceraclea senilis (Burmeister, 1839)

1♀, 16.vi.1972; 2♂, 14.vii.1972; 1♂, 2♀, 19.vii.1972; 1♀, v.1973; 1♂, 11.vi.1973; 1♀, 15.vi.1977. Although moderately common in still or slow water in a restricted part of south-east England, this is a 'Notable' species in Britain (Wallace, 1991); recorded from the London area. The larva feeds on freshwater sponges, so it would be interesting to confirm if the species really breeds in Buckingham Palace Garden lake.

Mystacides azurea (L., 1761)

vii [1964]; 1♀, 19.vii.1976. Common in still and flowing water; recorded from the Serpentine and the NHM Wildlife Garden.

Mystacides longicornis (L., 1758)

Larva [1964]; vi to x [1964]; 1♂, 28.vi.1972; 1♂, 1♀, 10.vii.1972; 3♂, 1♀, 14.vii.1972; 4♂, 5♀, 19.vii.1972; 1♂, 26.vii.1972; 1♂, 29.vii.1974; 1♀, 6.x.1978; 1♀, 20.vii.1995; 1♂, 24.viii.1995. Common in still and slow-flowing water; recorded from the Serpentine and the NHM Wildlife Garden.

Oecetis ochracea (Curtis, 1825)

vi to viii [1964]; 3♀, 19.vii.1972; 1♂, 24.viii.1995.
Common in still and slow-flowing water; recorded from the Serpentine and the NHM Wildlife Garden.

Leptocerus tineiformis Curtis, 1834

viii [1964] (recorded as *Setodes tineiformis*); 1♀, 19.vii.1972; 1♀, 20.vii.1995.
Common in weedy ponds and lakes in south-east England, although 'Notable' in other parts of the country (Wallace, 1991); recorded from the London area, including the NHM Wildlife Garden.

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Nematocera (Diptera) in Buckingham Palace Garden

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Abstract

Nematoceran Diptera were sampled in Buckingham Palace Garden using a single Malaise trap, operated from 20 April 1995 to 18 August 1997, and through field survey during the years 1997 and 1998. A total of 183 species was recorded. Together with additional species recorded in an earlier survey, the overall total of Nematocera for the Garden is 196. All of the recorded species are presented in an annotated list. Diptera other than Nematocera are the subject of a separate paper in this volume, by a different author.

Introduction and survey methods used

Visits were made to Buckingham Palace Garden on five occasions during 1997 and 1998. Nematocera collected on these trips were supplemented by those sorted by Colin Plant from samples accumulated through continuous use of a Malaise trap on The Mound, from 20 April 1995 to 18 August 1997.

Fungus gnats (Bolitophilidae, Keroplatidae and Mycetophilidae) are discussed more fully in a separate paper in this volume; Chironomidae are similarly treated by a different author. These species are included in the annotated list, below, without comment in order that a single, complete list of species may be presented.

An annotated list of Nematocera (Diptera) recorded in Buckingham Palace Garden

The sequence and nomenclature follow Chandler (1998). Species found in the earlier survey (Richards, 1964), but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey. The fungus gnat families (Bolitophilidae, Keroplatidae and Mycetophilidae) and the Chironomidae are the subject of separate chapters and their species are merely listed here, without comment, for sake of completeness. The lists for Tipulidae, Pediciidae and Limoniidae were compiled by Alan Stubbs (information on sample dates unavailable), the Psychodidae by Phil Withers and the Chaoboridae and Chironomidae by Peter Langton. Lists for other families were compiled by Peter Chandler.

DIPTERA
NEMATOCERA
TIPULOMORPHA
TIPULIDAE

Of the 87 British species of long-palped craneflies, seven are recorded from the Garden in the present survey, two of them being among the four species recorded during the previous survey. *Tipula vernalis*, *T. paludosa* and *Nephrotoma flavescens* typify dry grassland of reasonably natural character (the absence of *Nephrotoma appendiculata* (Pierre) is surprising), and *T. pagana* frequents mossy grass. *N. flavipalpis* is the only real woodland species and *Tipula confusa* develops in moss in shaded or unshaded situations. *N. guestfalica*, though nationally rather local, is not uncommon even well into London. Of the two species previously recorded, which are apparently no longer present, *Tipula cava* usually inhabits heathland and would not be expected in this type of habitat, while *T. oleracea* requires wet soil for development and areas adjacent to the lake may be drier now than formerly.

TIPULINAE

Nephrotoma flavescens (Linnaeus, 1758)
Malaise trap.

* *Nephrotoma flavipalpis* (Meigen, 1830)
Malaise trap. Also frequent in the wooded fringes of the Garden on August and October visits in 1997 and 1998. Also recorded in May and June on the previous survey.

N. guestfalica (Westhoff, 1879)
Malaise trap.

(*Tipula* (*Lunatipula*) *cava* Riedel, 1913)
Recorded at light in July during the previous survey.

Tipula (*Lunatipula*) *vernalis* Meigen, 1804
Malaise trap.

* *Tipula* (*Savtshenkia*) *confusa* van der Wulp, 1883
Malaise trap. Recorded in October on the previous survey.

Tipula (*Savtshenkia*) *pagana* Meigen, 1818
Malaise trap.

(*Tipula* (*Tipula*) *oleracea* Linnaeus, 1758)
Recorded in April and October on the previous survey, but the similar *T. paludosa* was not then recorded.

Tipula (*Tipula*) *paludosa* Meigen, 1830
Malaise trap. Also recorded at the north end of the Garden on 1.x.1998.

PEDICIIDAE

Most of the hairy-eyed craneflies have aquatic or semi-aquatic larvae, the sharp-sided lake margin being unsuitable. However, *Ula* develops in fungi in woodland and its survival so far into London is of note.

Ula mollissima Haliday, 1833
Recorded in the wooded fringe of the Garden on 1.x.1998.

LIMONIIDAE

This is the main group of short-palped craneflies with over 200 British species. Only six species are recorded from the Garden in the present survey; two of them were among the four species recorded during the previous survey. Most species need moist or very wet soils or gently sloping aquatic margins; only *Dicranomyia modesta* and *Symplecta stictica* represent this fauna in very poor habitat. The remaining species recorded from the Garden are typical of dry woodland and tree/shrub edges. *Trimicra pilipes* requires shelved water margins for development, so like *Tipula oleracea* has probably been lost because of changes in management of the lake since the previous survey. The record of *Dicranomyia mitis* (Meigen, 1830) form *lutea* Lackschewitz, 1928 on the previous survey was a misidentification of *D. chorea*; the record was for September and *mitis* itself is an early summer species.

CHIONEINAE

Cheilotrichia (*Empeda*) *cinerascens* (Meigen, 1804)
Malaise trap.

Symplecta stictica (Meigen, 1818)
Malaise trap.

(*Trimicra pilipes* (Fabricius, 1787))
Recorded in August on the previous survey.

LIMONIINAE

* *Dicranomyia chorea* (Meigen, 1818)
Malaise trap. Also recorded on The Mound and wooded fringes at the north end in June and October; on the previous survey it was recorded in April and September.

Dicranomyia modesta (Meigen, 1818)
Recorded on The Mound, the Island and around the wooded fringes on October 1998 visits.

Limonia nubeculosa Meigen, 1804
Malaise trap.

* *Rhipidia maculata* Meigen, 1818
Malaise trap. Recorded in May on the previous survey

BIBIONOMORPHA

BIBIONIDAE

Surprisingly, no species of the genus *Bibio* have been recorded in the Garden. *Dilophus febrilis* is generally very common. The larvae develop in soil, feeding on living and dead plant material and often cause damage to roots.

Dilophus febrilis (Linnaeus, 1758)
Malaise trap, a few seen from May and August samples.

BOLITOPHILIDAE

Bolitophila(Cliopisa) pseudohybrida Landrock, 1912

KEROPLATIDAE

KEROPLATINAE

Neoplatyura modesta (Winnertz, 1863)
Orfelia nemoralis (Meigen, 1818)
Orfelia tristis (Lundström, 1911)

MACROCERINAE

Macrocera phalerata Meigen, 1818
Macrocera stigmoides Edwards, 1925

MYCETOPHILIDAE

GNORISTINAE

Boletina gripha Dziedzicki, 1885

LEIINAE

Clastobasis alternans (Winnertz, 1863)
Docosia fumosa Edwards, 1925
Docosia gilvipes (Haliday in Walker, 1856)
Leia bimaculata (Meigen, 1804)
Leia fascipennis Meigen, 1818
Tetragoneura sylvatica (Curtis, 1837)

MYCETOPHILINAE

Exechiini

Allodia ornaticollis (Meigen, 1818)
Allodiopsis domestica (Meigen, 1830)
Brevicornu fissicauda (Lundström, 1911)
Brevicornu griseicolle (Staeger, 1840)
Brevicornu sericoma (Meigen, 1830)
Brevicornu verralli (Edwards, 1925)
Cordyla crassicornis Meigen, 1818
Cordyla fissa Edwards, 1925
Cordyla murina Winnertz, 1863
Cordyla pusilla Edwards, 1925
Exechia bicincta (Staeger, 1840)
Exechia fusca (Meigen, 1804)
Exechia repanda Johannsen, 1912
Exechia spinuligera Lundström, 1912
Tarnania fenestralis (Meigen, 1818)

Mycetophilini

Mycetophila britannica Lastovka & Kidd, 1975
Mycetophila cingulum Meigen, 1830
Mycetophila curviseta Lundström, 1911
Mycetophila fraterna Winnertz, 1863
Mycetophila freyii Lundström, 1909
* *Mycetophila fungorum* (De Geer, 1776)
Mycetophila ornata Stephens, 1846
Mycetophila pictula Meigen, 1830
Mycetophila trinotata Staeger, 1840
Mycetophila unicolor Stannius, 1831
Platurocypta punctum (Stannius, 1831)
Platurocypta testata (Edwards, 1925)
Phronia humeralis Winnertz, 1863
Sceptonia cryptocauda Chandler, 1991
Sceptonia flavipuncta Edwards, 1925
Sceptonia membranacea Edwards, 1925
Sceptonia nigra (Meigen, 1804)
Trichonta foeda Loew, 1869
Trichonta melanura (Staeger, 1840)
Zygomyia notata (Stannius, 1831)
Zygomyia pseudohumeralis Caspers, 1980
Zygomyia valida Winnertz, 1863
Zygomyia vara (Staeger, 1840)

MYCOMYINAE

Mycomya (*Mycomya*) *?flavicollis* (Zetterstedt, 1852)

SCIOPHILINAE

Acnemia nitidicollis (Meigen, 1818)
Sciophila parviareolata Santos Abreu, 1920
Sciophila lutea Meigen, 1818
Sciophila thoracica Staeger, 1840

SCIARIDAE

This family was not recorded during the previous survey. They develop mainly in decomposing materials, some in rotten wood and fungi but several of the species recorded in the Garden are known to develop in the nests of birds or mammals. Knowledge of the distribution of Sciaridae is still at an early stage. Most of the 22 species identified are known to be widespread; *Bradysia normalis* has been recorded mainly from Scotland, but is also known from Suffolk (Laurence, 1994) and Surrey (The Sheep Leas, Horsley, 16.v.1991, P.J. Chandler). Some other species of *Bradysia* were found, but await identification.

Bradysia amoena Winnertz, 1867
Malaise trap 19.vi – 18.vii and 18.vii – 13.viii.1997.

Bradysia arcana Menzel & Mohrig, 1998
Malaise trap 11.vii – 11.viii.1996, 5.ix – 21.x.1996 and 27.iii – 24.iv.1997.

Bradysia confinis (Winnertz, 1867)
Malaise trap 24.iv – 15.v.1997.

Bradysia normalis Frey, 1948
Malaise trap 3 – 10.viii.1995, 11.vii – 1.viii.1996, 26.v – 19.vi.1997 and 18.vii – 13.viii.1997.

Bradysia placida (Winnertz, 1867)
Malaise trap 19.ii – 27.iii.1997, 27.iii – 24.iv.1997 and 18.vii – 13.viii.1997.

Corynoptera curvispinosa Freeman, 1983
Malaise trap 27.v – 19.vi.1997.

Corynoptera forcipata (Winnertz, 1867)
Malaise trap 3 – 10.viii.1995, 10 – 17.viii.1995 and 20 – 28.ix.1995.

Corynoptera globiformis (Frey, 1945)
Malaise trap 20 – 28.ix.1995, 5.ix – 21.x.1996 and 18.vii – 13.viii.1997.

Corynoptera parvula (Winnertz, 1867)
Malaise trap 18.vii – 13.viii.1995.

Corynoptera sedula Mohrig & Krivosheina, 1985
Malaise trap 5.ix – 21.x.1996 and 27.iii – 24.iv.1997.

Ctenosciara hyalipennis (Meigen, 1804)
Malaise trap 19.ii – 27.iii.1997, 27.iii – 27.iv.1997 and 19.vi – 18.vii.1997.

Leptosciarella (Leptosciarella) rejecta (Winnertz, 1867)
Malaise trap 28.v – 27.vi.1995, 5.ix – 21.x.1996, 27.iii – 27.iv.1997, 19.vi – 18.vii.1997 and 18.vii – 13.viii.1997.

Leptosciarella (Leptosciarella) trochanterata (Zetterstedt, 1851)
Malaise trap 5.ix – 21.x.1996, 26.v – 19.vi.1997 and 18.vii – 13.viii.1997. On the Island on 13.viii.1997.

Lycoriella (Lycoriella) castanescens (Lengersdorf, 1940)
Malaise trap 27.iii – 27.iv.1997.

Lycoriella (Lycoriella) ingenua (Dufour, 1839)
Malaise trap 18.viii – 5.ix.1995 and 21.x – 28.xi.1996.

Phytosciara (Prosciara) ungulata (Winnertz, 1867)
Malaise trap 18.vii – 13.viii.1997.

Pseudolycoriella bruckii (Winnertz, 1867)
Malaise trap 27.vi – 16.vii.1996 and 26.v – 19.vi.1997.

Scatopsciara (Scatopsciara) atomaria (Zetterstedt, 1851)
Malaise trap 14.i – 19.ii.1997, 19.ii – 27.iii.1997 and 18.vii – 13.viii.1997.

Scatopsciara (Scatopsciara) multispina (Bukowski & Lengersdorf, 1936)
One male was found at the north end of the Garden on 26.vi.1998.

Scatopsciara (Scatopsciara) vitripennis (Meigen, 1818)
Malaise trap 7 – 20.v.1995, one female.

Schwenkfeldina carbonaria (Meigen, 1830)
Malaise trap18 – 27.vi.1996.

Trichosia (Trichosia) confusa Menzel & Mohrig, 1997
Malaise trap 15.viii – 5.ix.1995.

CECIDOMYIIDAE

This family of more than 600 British species was not studied during either survey. Many species are gall causers on plants and should be well represented in the Garden.

LESTREMIINAE

Lestremia cinerea Macquart, 1826
Malaise trap 7 – 20.v.1995.

CECIDOMYIINAE

Dasineura crataegi (Winnertz, 1853)
A gall causer on hawthorn, *Crataegus* species.

PSYCHODOMORPHA

PSYCHODIDAE

The moth flies or owl midges were not recorded during the previous survey and relatively few were sorted from Malaise trap catches during the present survey, so the list of 12 species identified may not be fully representative of the Garden's fauna. Most of the species recorded are terrestrial. *Trichomyia urbica* develops in rotten wood, *Philosepedon humeralis* develops in decaying snails and *Psychoda* species exploit a wide range of decaying materials; *P. cinerea* and *P. phalaenoides* develop in decaying terrestrial gill fungi as well as other decomposing materials. *Tinearia alternata* has been reared from nests of birds and mammals, as well as wet decomposing materials. The only aquatic species found, all of which occurred at the lake margin, were *Paramormia ustulata* and the two *Pericoma* species, of which *P. trivialis* is the most widespread and tolerant of pollution, while *P. pseudoexquisita* is often associated with algal mats.

PSYCHODINAE

Pericomini

Pericoma (*Pericoma*) *pseudoexquisita* Tonnoir, 1940
At lake margin 1.x.1998.

Pericoma (*Pneumia*) *trivialis* Eaton, 1893
At lake margin 13.viii1997 and 1.x.1998.

Psychodini

Psychoda albipennis Zetterstedt, 1850
Malaise trap 1.vi.1995; 11.vii – 1.viii.1996; >21.x.1996; 19.ii – 27.iii.1997; 16.v – 19.vi.1997; 19.vi – 18.vii.1997; 18.vii – 13.viii.1997. Light trap 1.vi.1995.

Psychoda cinerea Banks, 1894
Malaise trap 18.vii – 13.viii.1997.

Psychoda grisescens Tonnoir, 1922
Light trap 15.vi.1995.

Psychoda minuta Banks, 1894
Malaise trap 19.vi – 18.vii.97 and 18.vii – 13.viii.1997.

Psychoda phalaenoides (Linnaeus, 1758)
Malaise trap 20 – 28.vii.1995 and 18.vii – 13.viii.1997.

Psychoda setigera Tonnoir, 1922
Malaise trap 18.vii – 13.viii.1997.

Tinearia alternata (Say, 1824)
Malaise trap 17 – 24.viii.1995; 11.vii – 1.viii.1996; >21.x.1996.

Telmatoscopini

Paramormia ustulata (Haliday in Walker, 1856)
Malaise trap 31.viii – 7.ix.1995. Also at lake margin 1.x.1998

Philosepedon humeralis (Meigen, 1818)
Malaise trap 7 – 22.ix.1995.

TRICHOMYIINAE

Trichomyia urbica Haliday in Curtis, 1839
Malaise trap 7 – 20.v.1995 and 11.vii – 1.viii.1996.

TRICHOCERIDAE

It is surprising that only a single species of winter gnat was recorded on both surveys and that none were found in the Malaise trap catches; several other species should occur. Larvae develop in decaying vegetation and in fungi.

* *Trichocera* (*Metatrichocera*) *annulata* Meigen, 1818
This was recorded on the Island on 1.x.1998. It was also recorded in October by Richards (1964).

ANISOPODIDAE

Both species recorded develop in decaying vegetable matter, but *S. cinctus* also develops in fungi and sap runs.

Sylvicola cinctus (Fabricius, 1787)
Malaise trap 20.v – 23.vi.1995, 20.x – 21.xi.1995, 25.iii – 11.iv.1996 and 18.vii – 13.viii.1997. Also found on The Mound on 1.x.1998.

* *Sylvicola punctatus* (Fabricius, 1787)
Malaise trap >7.vii.1995, 14.i – 19.ii.1997 and 19.vi – 18.vii.1997. Recorded in May and October in the previous survey.

MYCETOBIIDAE

The species of this family develop in sap runs and associated wood detritus. *M. pallipes* is widespread, although it has been accorded Nationally Scarce conservation status.

Mycetobia pallipes Meigen, 1818
Malaise trap 18.vii – 13.viii.1997. It was also recorded in the wooded fringe near the north end on 1.x.1998.

SCATOPSIDAE

Only one species of this family was recorded on each survey, but several others should occur. They develop in decaying materials, including in the nests of birds and mammals.

SCATOPSINAE

Scatopsini

(*Scatopse notata* (Linnaeus, 1758))
This is a common species and was recorded during October on the previous survey.

Swammerdamellini

Swammerdamella brevicornis (Meigen, 1830)
Malaise trap 10 – 17.viii.1995.

CULICOMORPHA

CHAOBORIDAE

The single species recorded is common and has aquatic larvae, evidently developing in the lake.

Chaoborus (*Chaoborus*) *flavicans* (Meigen, 1830)
Malaise trap 31.viii – 7.ix.1995; 10 – 17.viii.1995.

CULICIDAE

The three species recorded by Edwards (1926) as developing in water-filled tree holes have not been found again on either survey, so *Culex pipiens* is the only mosquito confirmed to exist in the Garden today. *Orthopodomyia pulcripalpis* is currently accorded RDB3 conservation status and has been recorded at only four sites since 1960.

ANOPHELINAE

(*Anopheles* (*Anopheles*) *plumbeus* Stephens, 1828)

CULICINAE

(*Aedes* (*Finlaya*) *geniculatus* (Olivier, 1791))

Culex (*Culex*) *pipiens* Linnaeus, 1758
Malaise trap frequently from July to November. It was also recorded on The Mound and in the wooded fringes at the north end on 1.x.1998.

(*Orthopodomyia pulcripalpis* (Rondani, 1872))

CERATOPOGONIDAE

Relatively little material of this family has been studied from the Garden, except for *Dasyhelea dufouri*, which was seen to be abundant during visits by the author. The biting midges of the genus *Culicoides* appear to be scarce, but this may be due to lack of habitat as most develop in damp soil. Most of the species recorded are terrestrial as larvae, some in decaying vegetation or tree rot holes (some *Dasyhelea* species). *Culicoides scoticus* is a polyphagous fungus feeder and *Forcipomyia kaltenbachii* has also been reared from the fungus *Suillus luteus*, as well as from sap runs and under bark; *F. pulchrithorax* has also been reared from sap runs. Of the many species with aquatic larvae, only *Bezzia annulipes* was recorded during the present survey although one other, *Sphaeromias pictus*, was recorded during the previous survey. This is surprising, as some of the commoner species might have been expected to be present in the lake. *Forcipomyia eques* is not often recorded, but is of interest in that adult females suck fluids from the wing veins of lacewings (Neuroptera, Chrysopidae).

CERATOPOGONINAE

Culicoidini

Culicoides (*Avaritia*) *scoticus* Downes & Kettle, 1952
Light trap 1.vi.1995, male and female.

(*Culicoides* (*Culicoides*) *punctatus* (Meigen, 1804))
Recorded in July during the previous survey and determined by Paul Freeman.

Culicoides (*Oecacta*) *festivipennis* Kieffer, 1914
Light trap 1.vi.1995, male.

Culicoides (*Oecacta*) *vexans* (Staeger, 1839)
Light trap 15.vi.95.

Palpomyiini

Bezzia (*Homobezzia*) *annulipes* (Meigen, 1830)
Light trap 1.vi.1995, one female.

Sphaeromiini

(*Sphaeromias pictus* (Meigen, 1818))
This was taken at light in July during the previous survey. This is of interest as it was confused with *S. fasciatus* (Meigen, 1804) until recently, but was confirmed as British by Chandler (1994) and is widespread but uncommon.

DASYHELEINAE

Dasyhelea (*Dasyhelea*) *dufouri* (Laboulbène, 1869)
Malaise trap frequent from June to November. It was also numerous in all wooded parts of the Garden on 13.viii.1997, 26.vi.1998 and 1.x.1998.

Dasyhelea (*Dasyhelea*) *versicolor* (Winnertz, 18562)
Malaise trap 31.viii – 7.ix.1995 and 7 – 23.ix.1995, males; possible females were seen from several other samples.

Dasyhelea (*Dicryptoscena*) ?*notata* Goetghebuer, 1920
Malaise trap 10 – 17.viii.1995, 31.viii – 7.ix.1995 and 7 – 23.ix.1995. Females only were found.

FORCIPOMYIINAE

Forcipomyia (*Forcipomyia kaltenbachii* (Winnertz, 1852)
Light trap 1.vi.1995, one female.

Forcipomyia (*Forcipomyia*) *pulchrithorax* Edwards, 1924
Malaise trap 31.viii – 7.ix.1995 male and female, 7 – 23.ix.1995 female and 7 – 15.viii.1996 female.

Forcipomyia (*Trichohelea*) *eques* (Johannsen, 1908)
Light trap 15.vi.1995 female and 28.vii.1995 male. Malaise trap 18.vii – 13.viii.1997 female.

CHIRONOMIDAE

CHIRONOMINAE

Chironomini

Chironomus (Camptochironomus) pallidivittatus (Malloch, 1915)

Chironomus (Camptochironomus) tentans Fabricius, 1805

Chironomus (Chironomus) annularius auctt.

Chironomus (Chironomus) cingulatus Meigen, 1830

Chironomus (Chironomus) commutatus Keyl, 1960

Chironomus (Chironomus) dorsalis auctt.

Chironomus (Chironomus) luridus Strenzke, 1959

Chironomus (Chironomus) nuditarsis Keyl, 1961

Chironomus (Chironomus) piger Strenzke, 1959

★ *Chironomus (Chironomus) plumosus* (Linnaeus, 1758)

Chironomus (Chironomus) prasinus Meigen, 1804

Chironomus (Chironomus.) riparius Meigen, 1804

Cladopelma virescens (Meigen, 1818)

(*Cryptochironomus supplicans* (Meigen, 1830))

Dicrotendipes nervosus (Staeger, 1839)
Dicrotendipes objectans (Walker, 1856)
Einfeldia pagana (Meigen, 1838)
Endochironomus tendens (Fabricius, 1775)
Glyptotendipes (Glyptotendipes) glaucus (Meigen, 1818)
Glyptotendipes (Glyptotendipes) pallens (Meigen, 1804)
Microchironomus tener (Kieffer, 1918)
Microtendipes chloris (Meigen, 1818)
Microtendipes pedellus (De Geer, 1776)
Parachironomus arcuatus (Goetghebuer, 1919)
Parachironomus frequens (Johannsen, 1905)
(*Parachironomus monochromus* (van der Wulp, 1874))
Polypedilum (Pentapedilum) sordens (van der Wulp, 1874)
Polypedilum (Polypedilum) acutum Kieffer, 1915
* *Polypedilum (Polypedilum) nubeculosum* (Meigen, 1804)
Polypedilum (Polypedilum) pedestre (Meigen, 1830)
Polypedilum (Tripodura) scalaenum (Schrank, 1803)

Tanytarsini
(*Micropsectra junci* (Meigen, 1818))
Paratanytarsus dissimilis (Johannsen, 1905)
(*Paratanytarsus laetipes* (Zetterstedt, 1850))
Tanytarsus eminulus (Walker, 1856)
Tanytarsus mendax Kieffer, 1925
Tanytarsus usmaensis Pagast, 1931

ORTHOCLADIINAE
Bryophaenocladius aestivus (Brundin, 1947)
Bryophaenocladius ictericus (Meigen, 1830)
Bryophaenocladius nidorum (Edwards, 1929)
Bryophaenocladius vernalis (Goetghebuer, 1921)
Cricotopus (Cricotopus) annulator Goetghebuer, 1927
Cricotopus (Cricotopus) bicinctus (Meigen, 1818)
Cricotopus (Cricotopus) similis Goetghebuer, 1921
Cricotopus (Isocladius) intersectus (Staeger, 1839)
Cricotopus (Isocladius) sylvestris (Fabricius, 1794)
Limnophyes natalensis (Kieffer, 1914)
Limnophyes paludis Armitage, 1985
Metriocnemus eurynotus (Holmgren, 1883)
Metriocnemus fuscipes (Meigen, 1818)
Metriocnemus picipes (Meigen, 1818)
Paratrichocladius rufiventris (Meigen, 1830)
Smittia aterrima (Meigen, 1818)
Smittia pratorum (Goetghebuer, 1927)

TANYPODINAE
Macropelopiini
Psectrotanypus (Psectrotanypus) varius (Fabricius, 1787)

Pentaneurini

Ablabesmyia monilis (Linnaeus, 1758)
Conchapelopia melanops (Meigen, 1818)

Procladiini

* *Procladius (Holotanypus) choreus* (Meigen, 1804)
Procladius (Holotanypus) sagittalis (Kieffer, 1909)
Procladius (Psilotanypus) lugens Kieffer, 1915
* *Procladius (Psilotanypus) rufovittatus* (van der Wulp, 1874)

Tanypodini

Tanypus punctipennis Meigen, 1818
Tanypus vilipennis (Kieffer, 1918)

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Fungus Gnats (Diptera: Bolitophilidae, Keroplatidae and Mycetophilidae) in Buckingham Palace Garden

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Abstract

Fungus gnats (Diptera: Bolitophilidae, Keroplatidae and Mycetophilidae) were sampled at Buckingham Palace Garden, using a single Malaise trap operated from 1995 to 1997 (samples were examined from 20.iv.1995 to 13.viii.1997) and five field visits in 1997 and 1998. A total of 56 species were recorded, only one of which had been recorded in an earlier survey. The species are listed and their biological associations discussed. The fauna was larger than might be expected in a site of this type but most species were recorded in small numbers, reflecting availability of suitable habitat.

Introduction and survey methods used

There are 535 British species of fungus gnats belonging to the above families and two smaller families not found in the Garden, Ditomyiidae and Diadocidiidae. Most species are associated as larvae with fungi. Many develop internally in the tissue of gill fungi, boletes or the softer polypores. The larvae of many others live in more or less slimy webs on the surface of wood encrusting fungi or rotten wood and some develop internally in rotten wood, feeding on fungal mycelium. Some of the web spinners are spore feeders while others have carnivorous larvae. A few develop in bird's nests while the biology of some genera is unknown.

This group was not studied during the previous survey (Richards, 1964) and only one common species, *Mycetophila fungorum* (De Geer) was then recorded. This and 55 other species were found during the present survey, mostly recorded from the Malaise trap samples from April 1995 to August 1997, which produced 51 species. Specimens were, however, mostly in low numbers and relatively few species (a maximum of 22) were found in each sample.

Five visits were also made by the author in 1997 and 1998, three of them in October, usually a peak month for this group, coinciding with greater abundance of fruiting bodies of the larger fungi. However adults were in small numbers, both of individuals and species, on all visits and only 16 species were recorded altogether (15 of them during October) and only five of these were not found in the Malaise trap. There is also usually another peak in early summer, but visits at that time were not practicable. The other visits were on 26 June 1998 and 13 August 1997 and these produced only one and three species respectively.

This was partly attributable to dry prevailing weather, but the autumn in 1998 was wetter and following a visit on 1 October, a second was arranged on 19 October. On the latter visit, fungus fruiting bodies were especially prolific and according to Alick Henrici who was present on that occasion, more abundant than he had previously seen there. However, that visit was of necessity curtailed and few species were recorded; two species were subsequently reared from a fresh cap of the fly agaric *Amanita muscaria*, of which there was a colony on the lakeshore. No further recording was practicable after that date.

Results

Most species of this group favour woodland and forest habitats and a large fauna would not be expected in such an intensively managed site. The total of 56 species eventually achieved (10.5 per cent. of the British species) is probably not far short of the actual fauna of the Garden, but more intensive recording at different times of year and in more favourable seasons would probably add several other widespread species.

An annotated list of the fungus gnats (Diptera: Bolitophilidae, Keroplatidae and Mycetophilidae) recorded in Buckingham Palace Garden

Nomenclature and arrangement follow Chandler (1998) except in respect of changes in Chandler (2001). The biology of species, where known, is stated; this information is mainly based on the compilation of known fly/fungus associations by Yakovlev (1994). The single species found on both surveys is asterisked.

NEMATOCERA

BIBIONOMORPHA

BOLITOPHILIDAE

Bolitophila(Cliopisa) pseudohybrida Landrock, 1912
Malaise trap 20.x – 20.xi.1995. On 19.x.1998 at the north end of the Garden and on the Island in the lake. This species develops in a wide range of terrestrial gill fungi.

KEROPLATIDAE

KEROPLATINAE

Neoplatyura modesta (Winnertz, 1863)
Malaise trap in July and August 1995 and 1997.

Orfelia nemoralis (Meigen, 1818)
Malaise trap frequently from April to August.

Orfelia tristis (Lundström, 1911)
Malaise trap 21.v – 23.vi.95, a male and female. This is a local species of dry grassland and other open habitats.

MACROCERINAE

Macrocera phalerata Meigen, 1818
Malaise trap in October 1996.

Macrocera stigmoides Edwards, 1925
Malaise trap 25.iv – 9.v.1996.

MYCETOPHILIDAE

GNORISTINAE

Boletina gripha Dziedzicki, 1885
Malaise trap regularly from October throughout the winter months to June, with one record for a July/August sample. There is a rearing record from the bolete *Suillus bovinus* but *B. gripha* is a very common species and may not be a regular fungus feeder.

LEIINAE

Clastobasis alternans (Winnertz, 1863)
Malaise trap from the period to 7.vii.1995, one male. See discussion below.

Docosia fumosa Edwards, 1925
Malaise trap to 21.x.1996, both sexes. This species is local in occurrence but develops in bird's nests and is most often recorded by rearing.

Docosia gilvipes (Haliday in Walker, 1856)
Malaise trap from April to November. It is polyphagous in a wide range of fungi, both terrestrial and growing on wood, including polypores and encrusting fungi.

Leia bimaculata (Meigen, 1804)
Malaise trap from April to December. This species is polyphagous in soft fungi, both terrestrial and growing on wood.

Leia fascipennis Meigen, 1818
Malaise trap in several samples from May – July and October. It is a common species, found mainly on tree foliage but the biology is not recorded. Some other species of the genus develop in bird's nests.

Tetragoneura sylvatica (Curtis, 1837)
Malaise trap 20.v – 23.vi.1995, 31.viii – 7.ix.1995. There is a rearing record from an encrusting fungus but it has also been reared from rotten wood, where the larvae probably feed on fungal mycelium.

MYCETOPHILINAE

Exechiini

Allodia ornaticollis (Meigen, 1818)
This was found on the island on 19.x.1998 and subsequently reared from *Amanita muscaria*, which was growing on the lake shore on the same visit. The species is polyphagous in gill fungi (including those growing on wood) and boletes.

Allodiopsis domestica (Meigen, 1830)
Malaise trap 19.vi – 18.vii.1997, one male. It develops in a wide range of terrestrial gill fungi.

Brevicornu fissicauda (Lundström, 1911)
Malaise trap 14.i – 19.ii.1997.

Brevicornu griseicolle (Staeger, 1840)
Malaise trap from November to December, February to April and June to July. It was also recorded widely in the garden on October visits, including the northern wooded fringe, the Island in the lake and on The Mound. It has been reared from terrestrial gill fungi of the genera *Hebeloma*, *Inocybe* and *Cortinarius*.

Brevicornu sericoma (Meigen, 1830)
Malaise trap 21.x – 28.xi.1996. There is one rearing record from the terrestrial gill fungus *Amanita rubescens*.

Brevicornu verralli (Edwards, 1925)
Malaise trap 21.x – 28.xi.1996.

Cordyla crassicornis Meigen, 1818
Malaise trap from February to August and October to November. This species develops in terrestrial gill fungi of the genera *Lactarius* and *Russula*.

Cordyla fissa Edwards, 1925
Malaise trap 19.vi – 18.vii.1997. There is a rearing record from the bolete *Suillus luteus*.

Cordyla murina Winnertz, 1863
Malaise trap from March to August. This develops in terrestrial gill fungi and boletes.

Cordyla pusilla Edwards, 1925
Malaise trap from January to February and April to August.

Exechia bicincta (Staeger, 1840)
Found in the wooded fringe on the northwest side on 1.x.1998. It develops in gill fungi, both terrestrial and growing on wood.

Exechia fusca (Meigen, 1804)
Malaise trap 19.vi – 18.vii.1997. Recorded around the wooded fringes and on the Island in the lake on October visits. This species is polyphagous in mainly terrestrial gill fungi and boletes.

Exechia repanda Johannsen, 1912
Malaise trap 19.vi – 18.vii.1997, one male. It has been reared from several genera of terrestrial gill fungi.

Exechia spinuligera Lundström, 1912
Malaise trap 21.x – 28.xi.1996. This has a similar range of host fungi to *E. fusca*.

Tarnania fenestralis (Meigen, 1818)
This was recorded on the Island on 1.x.1998. This species is polyphagous in the larger terrestrial gill fungi.

Mycetophilini

Mycetophila britannica Lastovka & Kidd, 1975
Malaise trap from October to December. On both visits in October 1998 it occurred around the wooded fringe at the north end. This has been reared from several genera of terrestrial gill fungi but also from the honey fungus *Armillaria mellea* and the soft polypore *Polyporus squamosus*.

Mycetophila cingulum Meigen, 1830
Malaise trap from July to October. This species regularly develops in *Polyporus squamosus*, but adults have also twice been recorded visiting colonies of another soft textured polypore *Grifola frondosa*.

Mycetophila curviseta Lundström, 1911
Malaise trap 18.vii – 17.viii.1997. Found around logs north of the office area on 1.x.1998 and on The Mound on 13.viii.1997. Biology unrecorded but usually around rotten wood.

Mycetophila fraterna Winnertz, 1863
This was recorded on the Island on 31.x.1997. It has been reared from the polypore fungus *Physisporinus vitreus* (Chandler, 1993).

Mycetophila freyii Lundström, 1909
Malaise trap 18.vii – 13.viii.1997, one male.

* *Mycetophila fungorum* (De Geer, 1776)
Malaise trap samples for most months from March to October. It was also found on the Island on 1.x.1998 and reared from *Amanita muscaria* growing on the lake shore on 19.x.1998. This is polyphagous in boletes and gill fungi, both terrestrial and growing on wood. It was recorded in October on the previous survey.

Mycetophila ornata Stephens, 1846
Malaise trap 21.x – 28.xi.1996, one female. This common species is confined to polypores and wood encrusting fungi.

Mycetophila pictula Meigen, 1830
Malaise trap 1 – 15.viii.1996. There is a rearing record from a wood encrusting fungus.

Mycetophila trinotata Staeger, 1840
Malaise trap in June 1995 and July – August 1997. It was recorded around logs north of the office area on 1 October 1998. This is another common species, developing in polypores and encrusting fungi.

Mycetophila unicolor Stannius, 1831
Malaise trap 20.v – 23.vi.1995.

Platurocypta punctum (Stannius, 1831)
Malaise trap in October 1996 and June to July 1997. It was also recorded at the north end of the Garden on 1.x.1998. This species develops in myxomycetes growing on rotten wood.

Platurocypta testata (Edwards, 1925)
Malaise trap in July and November to December. It was also found near the lakeshore in August. The biology is the same as for *P. punctum*.

Phronia humeralis Winnertz, 1863
Malaise trap 9 – 23.v.1996. The larvae of this species develop on the surface of encrusting fungi on damp rotten wood.

Sceptonia cryptocauda Chandler, 1991
Malaise trap from May to October.

Sceptonia flavipuncta Edwards, 1925
Malaise trap 19.vi – 13.vii.1997, one male.

Sceptonia membranacea Edwards, 1925
Malaise trap 19.vi – 13.vii.1997.

Sceptonia nigra (Meigen, 1804)
Malaise trap 16.v – 19.vi.1997, but it was recorded on four visits in June, August and October. It was swept from tree foliage on the Island, around the lakeshore and on The Mound.

Trichonta foeda Loew, 1869
Malaise trap 23.ii – 5.iii.1996. This species develops in the wood encrusting fungus *Stereum hirsutum*.

Trichonta melanura (Staeger, 1840)
Malaise trap 19.vi – 18.vii.1997. This has also been reared from *Stereum*.

Zygomyia notata (Stannius, 1831)
Malaise trap, frequently from May to November.

Zygomyia pseudohumeralis Caspers, 1980
Malaise trap, several specimens from June to August.

Zygomyia valida Winnertz, 1863
Malaise trap in period to 21.x.1996 and 16.v – 19.vi.1997. It was also found on the Island in October.

Zygomyia vara (Staeger, 1840)
Recorded on the Island on 1.x.1998.

MYCOMYINAE

Mycomya (Mycomya) ?flavicollis (Zetterstedt, 1852)
Malaise trap 31.viii – 7.ix.1995, a probable female. Biology unrecorded but most *Mycomya* species form webs on the surface of fungi growing on wood.

SCIOPHILINAE

Acnemia nitidicollis (Meigen, 1818)
Malaise trap 21.x – 28.xi.1996. There are two rearing records from boletes of the genus *Leccinum* but this very common species may not be a regular fungus feeder.

Sciophila parviareolata Santos Abreu, 1920
Malaise trap 12 – 24.viii.1995, 22.ix – 30.x.1995, 27.iii –24.v.1997 and 19.vi – 18.vii.1997. See discussion below.

Sciophila lutea Meigen, 1818
Malaise trap from May to August, typical yellow specimens and 27.iii – 24.iv.1997. darker specimens. This species is polyphagous, with rearing records from the larger ascomycetes as well as polypores, boletes and gill fungi.

Sciophila thoracica Staeger, 1840
Malaise sample 16.v – 19.vi.1997, one male and 19.vi – 18.vii.1997, four males. See discussion below. It has been reared from the bolete *Suillus luteus*.

Discussion

Of the species recorded most were common or widespread in Britain, but a few were of particular interest. Most curious was the find of one male of *Clastobasis alternans* in the Malaise trap. This species was only recently first recorded in Britain and is now known from four other sites scattered in England north to Yorkshire, all of them more or less wooded wetlands (Chandler, 2001). Its occurrence in the absence of any comparable habitat is therefore surprising and it is even difficult to believe that it could have been a vagrant. *Sciophila parviareolata* has also been recently recognised as a British species (Chandler, 2001), but it has previously been confused with the commoner species *S. hirta* Meigen. While *hirta* has been reared from a wide range of fungi growing on wood, no rearing record of *parviareolata* has yet been established; curiously most of the British records are of specimens taken at windows indoors, including two national museums and the records from the Garden are the first in Britain since 1936.

Two other uncommon species were also recorded during the survey. *Sceptonia flavipuncta* has been recorded from ten sites in southern England and Wales, mostly in recent years. *Sciophila thoracica* was first found in Britain in 1974 and was described as *S. quadriterga* by Hutson (1979), but synonymised with *thoracica* Staeger following examination of types by Chandler (2001). It has also been recorded previously from ten sites in southern England and Wales.

Of the 56 species recorded, 23 (including *Bolitophila* and the 15 Exechiini) are known or likely to be associated mainly with terrestrial fungi (although gill fungus feeders may also develop in those growing on wood) and 12 develop in polypores or encrusting fungi on wood. The two *Platurocypta* species develop in myxomycetes (also living on rotten wood) and *Docosia fumosa* is a regular inhabitant of birds' nests. Most of the Keroplatidae are predaceous web spinners on fungi, dead wood or other substrates as larvae. The biology of the genera *Clastobasis*, *Sceptonia* and *Zygomyia* is unknown. The two latter genera include several common species and are unlikely to be fungus feeders; the adults of *Sceptonia* are mainly found on tree foliage.

The composition of the fungus gnat fauna reflects the available habitats and not surprisingly most species were recorded in low numbers. Several of the species found more commonly in the Garden are very polyphagous (i.e. having a wide range of fungus hosts) and are thus able to take advantage of available fungi, even under unfavourable conditions. While a good range of fungi are recorded in the garden, there was a lack of habitat for those associated with dead wood. It was understood that control measures, using a fungicide, are taken against fairy rings on the lawns and caps of the honey fungus *Armillaria mellea* were removed by garden staff during one of the author's visits. As suggested elsewhere in this volume retention of more dead wood, especially in shaded situations, would benefit both fungi and the insects developing in them.

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Non-biting midges (Diptera: Chironomidae) in Buckingham Palace Garden

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Abstract

Over the years 1995 to 1998, 60 species of non-biting midge (Diptera: Chironomidae) were collected in Buckingham Palace Garden using a Malaise trap on The Mound and by sweeping vegetation. Four further species were recorded in the earlier survey (1961–1963), bringing the total for the Garden to 64. An annotated list is provided. The habitats within the Garden would be expected to generate such a spectrum of 'terrestrial' and aquatic species.

Introduction and origin of specimens

In the account of the previous survey of the natural history of Buckingham Palace Garden (1961 to 1963), Paul Freeman (in Richards, 1964) listed six species of chironomid obtained by light trapping. This is a remarkably small number for a large garden with a substantial shallow lake and damp organically enriched soil, particularly for a group of flies that is attracted to light in large numbers. Three further species were recorded from 'leaves by lake' making nine in total. It appears that the chironomids were occasional by-products of collecting other insects. Strangely, the three species collected from leaves by the lake were not collected in this survey.

Most of the material that arrived for identification in this survey was collected in a Malaise trap operated on The Mound between 7 May 1995 and 18 August 1997; further material was collected by D. J.Carter at a light trap and by P. J. Chandler sweeping vegetation with a net.

Results

The list below records a total of 64 species for the Garden; notes on phenology, larval habitat and distribution are appended: it is to be assumed that the specimens originated from The Mound (trapped or swept) unless otherwise stated. All the species are frequent to common and generally widespread in lowland Britain.

Annotated list of non-biting midges (Diptera: Chironomidae) recorded in Buckingham Palace Garden

The arrangement of taxa follows that of Chandler (1998). Species found only in the earlier survey are enclosed in round brackets. Taxa found in both surveys are indicated with an asterisk (*). Taxa found for the first time in this survey are unmarked.

CHIRONOMIDAE

CHIRONOMINAE

Chironomini

Larvae of the recorded species are either herbivorous or detritus feeders, living in shallow stagnant water.

Chironomus (Camptochironomus) pallidivittatus (Malloch, 1915)
Light trap 15 June 1995.

Chironomus (Camptochironomus) tentans Fabricius, 1805
Malaise trap June–August; 1995, 1996. Recorded by Paul Freeman for May in the earlier survey.

Chironomus (Chironomus) annularius auctt.
Malaise and light traps April, June–November; 1995, 1996, 1998. Particularly associated with small water bodies such as water butts.

Chironomus (Chironomus) cingulatus Meigen, 1830
Malaise trap June 1996.

Chironomus (Chironomus) commutatus Keyl, 1960
Swept in the 'northern fringes' on 26.vi.1998.

Chironomus (Chironomus) dorsalis auctt.
Swept on The Mound on 26.vi.1998. Breeds mainly in very shallow pools.

Chironomus (Chironomus) luridus Strenzke, 1959
Malaise trap January, February, April, June–November; 1996–1997. Characteristic of shaded stagnant water.

Chironomus (Chironomus) nuditarsis Keyl, 1961
Malaise trap April/May 1997.

Chironomus (Chironomus) piger Strenzke, 1959
Malaise trap September/October 1996.

* *Chironomus (Chironomus) plumosus* (Linnaeus, 1758)
Malaise trap April, June–November; 1995–1998; light trap30.vi.1995. Adults also swept from the Island and 'shrubby areas'. Recorded by Paul Freeman for September in the earlier survey. Breeds in lakes; larvae in mud.

Chironomus (Chironomus) prasinus Meigen, 1804
Malaise trap October 1996.

Chironomus (Chironomus.) riparius Meigen, 1804
Malaise trap May 1996. The larvae are poor at competing with other *Chironomus* species but are able to survive very low oxygen levels and so are characteristic of highly organically polluted waters. The species is, however, opportunistic and it is frequently found in new habitats, e.g. a bucket that is left outside and fills with rainwater.

Cladopelma krusemani (Goetghebuer, 1935)
Light trap 20.vii.1995.

Cladopelma virescens (Meigen, 1818)
Malaise trap April/May 1997.

(*Cryptochironomus supplicans* (Meigen, 1830))
Not recorded in the present survey but recorded by Paul Freeman in the earlier survey for October.

Dicrotendipes nervosus (Staeger, 1839)
Malaise trap April – November; 1995–1997; light trap 20.vii.1995. Adults common all over the garden in 1997–1998.

Dicrotendipes objectans (Walker, 1856)
Malaise trap September–October; 1995 and 1996.

Einfeldia pagana (Meigen, 1838)
Malaise trap June 1996.

Endochironomus tendens (Fabricius, 1775)
Malaise trap August–October; 1995, 1996. The larva mines the leaves of submerged broad-leaved macrophytes.

Glyptotendipes (Glyptotendipes) glaucus (Meigen, 1818)
Malaise trap May–October; light trap 6.vi and 22.ix.1995. Adults were also swept in the 'northern fringes' in 1998. Larvae frequently mine submerged macrophyllous plants.

Glyptotendipes (Glyptotendipes) pallens (Meigen, 1804)
Malaise trap March, April, June–October; light trap 1.vi.995. Also collected on the Island in 1998. Larvae may mine submerged leaves of aquatic plants.

Microchironomus tener (Kieffer, 1918)
Malaise trap June, August; 1995, 1996.

Microtendipes chloris (Meigen, 1818)
Malaise trap February, March, June, July, September, October; 1996, 1997.

Microtendipes pedellus (De Geer, 1776)
Malaise trap April–October; 1995–1997. Adults collected all over the Garden in 1997– 1998.

Parachironomus arcuatus (Goetghebuer, 1919)
Malaise trap February–November; 1995–1997. Light trap 13.vii.1995.

Parachironomus frequens (Johannsen, 1905)
Malaise trap June–July 1996. Also swept on the Island on 26.vi.1998.

(*Parachironomus monochromus* (van der Wulp, 1874))
Not encountered in this survey but recorded by Paul Freeman in the earlier survey for May 'on leaves by lake'.

Polypedilum (Pentapedilum) sordens (van der Wulp, 1874)
Malaise trap July/August 1997.

Polypedilum (Polypedilum) acutum Kieffer, 1915
Malaise trap September/October 1995.

* *Polypedilum (Polypedilum) nubeculosum* (Meigen, 1804)
Malaise trap February–October; 1995–1997. Adults collected all over the Garden in 1997 – 1998. Paul Freeman recorded the species in the earlier survey for June and September.

Polypedilum (Polypedilum) pedestre (Meigen, 1830)
Malaise trap April 1996.

Polypedilum (Tripodura) scalaenum (Schrank, 1803)
Malaise trap April–September; 1995–1997.

Tanytarsini

Larvae feed mainly on microphytes and debris.

(*Micropsectra junci* (Meigen, 1818))
Not encountered in this survey but recorded by Paul Freeman in the earlier survey for May 'on leaves by lake'. Breeds characteristically in seepages.

Paratanytarsus dissimilis (Johannsen, 1905)
Light trap on 15.vi and 20.vii.1995. Also swept on the Island on 26.vi.1998. Breeds in shallow, stagnant or running water.

(*Paratanytarsus laetipes* (Zetterstedt, 1850))
Recorded by Paul Freeman for May 'on leaves by lake', but not encountered in this survey.

Tanytarsus eminulus (Walker, 1856)
Malaise trap June, September; 1995, 1996. Larvae in shallow, stagnant or running water.

Tanytarsus mendax Kieffer, 1925
Malaise and light traps May–October; 1995–1997. Swept also from the Island in 1998. Breeds in the shallow water of lakes.

Tanytarsus usmaensis Pagast, 1931
Malaise trap April, May, August; 1995, 1996. Larvae in shallow water, mainly stagnant.

ORTHOCLADIINAE

The larvae are detritivores or herbivores.

Bryophaenocladius aestivus (Brundin, 1947)
Malaise trap May, July; 1995. Terrestrial; probably breeding in damp humus-rich soil.

Bryophaenocladius ictericus (Meigen, 1830)
Malaise trap July–October; 1995–1997. Adults collected also in 'shrubby areas near edge' in 1997. Breeds in moss away from the soil.

Bryophaenocladius nidorum (Edwards, 1929)
Malaise trap June 1995. Breeds in birds' nests (Edwards, 1929) and moss on roofs (Strenzke, 1952).

Bryophaenocladius vernalis (Goetghebuer, 1921)
Malaise trap June/July 1997. Breeds in wet soil (Fittkau quoted in Lehmann, 1971)

Cricotopus (Cricotopus) annulator Goetghebuer, 1927
Malaise and light traps May, June; 1995, 1996. Larvae in stagnant and flowing water.

Cricotopus (Cricotopus) bicinctus (Meigen, 1818)
Malaise and light traps May–October; 1995–1997 and swept on The Mound in 1998. Breeds in stagnant and flowing water.

Cricotopus (Cricotopus) similis Goetghebuer, 1921
Malaise trap October/November 1996. Larvae in stagnant and flowing water.

Cricotopus (Isocladius) intersectus (Staeger, 1839)
Malaise trap March/April 1996. Breeds in shallow stagnant water lakes and slow flowing water; larvae in submerged moss and on other macrophytes.

Cricotopus (Isocladius) sylvestris (Fabricius, 1794)
Malaise trap March–August; 1995–1997. Breeds mainly in stagnant water; larvae usually close to the water surface in filamentous algae or on macrophytes.

Limnophyes natalensis (Kieffer, 1914)
Malaise trap May 1995. Larvae are found in wet moss and leaf litter.

Limnophyes paludis Armitage, 1985
Malaise trap May, July–October; 1995–1997. More aquatic than most *Limnophyes* species, the larvae feeding on submerged dying grass leaves.

Metriocnemus eurynotus (Holmgren, 1883)
Malaise trap January/February 1997. A particularly abundant and widespread species in the early part of the year; larvae in floating filamentous algae and in wet moss.

Metriocnemus fuscipes (Meigen, 1818)
Malaise trap January–June; 1996, 1997. Larvae in damp moss on the ground.

Metriocnemus picipes (Meigen, 1818)
Malaise trap September/October 1995. Stagnant water (Spärck, 1922).

Paratrichocladius rufiventris (Meigen, 1830)
Malaise trap May–June 1996. Adults also swept in the 'northern fringes' on 26.vi.1998. Larvae on submerged macrophytes and in debris in stagnant and flowing water.

Smittia aterrima (Meigen, 1818)
Malaise and light traps October–March, June; 1995–1997. Larvae in damp soil.

Smittia pratorum (Goetghebuer, 1927)
Malaise trap September 1995. Larvae in soil; known to attack *Narcissus* bulbs (Edwards, 1929).

TANYPODINAE

The larvae are to a greater or lesser extent predators, small chironomid larvae often forming a large proportion of their diet. All the species recorded here breed in shallow stagnant water.

Macropelopiini

Psectrotanypus (Psectrotanypus) varius (Fabricius, 1787)
Malaise trap March–July; 1995–1997.

Pentaneurini

Ablabesmyia monilis (Linnaeus, 1758)
Malaise trap June, August; 1995, 1996.

Conchapelopia melanops (Meigen, 1818)
Malaise trap August 1995.

Procladiini

* *Procladius (Holotanypus) choreus* (Meigen, 1804)
Malaise and light traps March–July, October, November; 1995, 1996. Recorded for April, May and July in the earlier survey by Paul Freeman.

Procladius (Holotanypus) sagittalis (Kieffer, 1909)
Malaise trap February–October; 1995–1998.

Procladius (Psilotanypus) lugens Kieffer, 1915
Malaise trap March–June, August–October; 1995, 1996.

* *Procladius (Psilotanypus) rufovittatus* (van der Wulp, 1874)
Malaise and light traps July–September 1995. Recorded for July by Paul Freeman in the earlier survey.

Tanypodini

Tanypus punctipennis Meigen, 1818
Malaise trap April–November; 1995–1997. The most abundant species of Chironomidae in the Garden, also swept from the Island, lake margin and 'northern fringes' in 1997–1998.

Tanypus vilipennis (Kieffer, 1918)
Swept on The Mound on 26.vi.1998.

Discussion

No species restricted to running water or characteristic of deep water have been collected in the Garden: all the species recorded can breed within the confines of the Garden and its managed permanent habitats. The Malaise trap appears to have been particularly efficient in sampling the Chironomidae of the Garden. Only three species collected by sweeping vegetation (*Chironomus commutatus*, *Chironomus dorsalis* and *Tanypus vilipennis*) were not represented in Malaise or light trap collections. However, netted specimens were submitted from only four days (13 August, and 31October 1997; 26 June and 1 October 1998), allowing speculation that a few species could have avoided collection by both methods. This could explain the apparent absence of the three species which were recorded for May 'on leaves by lake' in the earlier survey.

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PLATE J. Buckingham Palace Garden, London. View of The Lake, adjacent to The Mound. Freshwater, especially with marginal vegetation, makes an important contribution to the overall ecology of urban sites. *Photographed © by Mark Lane*

Brachycera (Diptera) in Buckingham Palace Garden

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Abstract

Brachycera (Diptera) were sampled at Buckingham Palace Garden, using a Malaise trap operated continuously between 20 April 1995 and 18 August 1997. These collections were supplemented by active fieldwork during the period 1995 to 1998 by several entomologists. A total of 484 species was recorded. An earlier survey, carried out in the early 1960s recorded 68 species. Taken together, the two lists provide an overall total of 511 species of Brachycera in the Garden. All species are listed with brief notes.

Introduction and survey methods

An earlier survey at Buckingham Palace Garden (Richards 1964) recorded a total of 68 species of Brachyceran Diptera. As a part of the overall programme of resurvey, a single Malaise trap was operated continuously at a fixed position on The Mound, from 20 April 1995 to 18 August 1997 and Diptera from this were passed to me for naming. In addition to this passive trapping, active fieldwork was carried out in the garden. Colin Plant visited on many occasions during the years 1995 to 1998 and passed to me all of the Brachycera other than the Syrphidae and a few other smaller families. Peter Chandler visited the garden on five occasions during 1997 and 1998 and provided me with a full list of his captures.

Identification of material

Specimens from the Malaise trap were sorted by Colin Plant, who was also responsible for identifications of Rhagionidae, Tabanidae, Stratiomyidae, Bombyliidae, Asilidae and Syrphidae. Phoridae were identified by Henry Disney. Nigel Wyatt identified flies from a few of the Malaise trap samples and Adrian Plant was responsible for the identification of a few of the Empididae and Hybotidae. Peter Chandler named the samples that he himself had collected. All remaining material, comprising the bulk of the Malaise trap samples, was identified by the author.

Results

A complete list of the Brachycera recorded at Buckingham Palace Garden is presented below. Two families have been singled out for special treatment: the Phoridae are presented as a separate paper by Henry Disney and the Syrphidae are similarly treated by Colin Plant. Nevertheless, the species in these two families are included in the present list, without comment, in order that a single, complete list of Brachycera may be presented.

Within the list, Malaise trap records are indicated individually unless they exceed four. If a species was present in more than four collections then only the months in which it was taken are given. No attempt was made to note the relative abundance of each species in the collections; consequently 'a record' could consist of a few specimens to literally hundreds of individuals. In order to avoid cluttering up the list, records made during visits by Peter Chandler are coded by locality as follows:

A Partly wooded fringes from the offices up to the compost area and rose garden (all visits);
B Island in The Lake (all visits)
C Lake margin opposite the Palace (August visit only)
D Secondary woodland over rank grasses on The Mound (all visits)

An annotated list of the Brachycera (Diptera) recorded in Buckingham Palace Garden

The sequence and nomenclature in the list follow Chandler (1998) and the subsequent updates Chandler (1999 and 2000). Species found in the earlier survey (Richards 1964), but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey. The notes on larvae were mainly based on the information contained in Smith (1989).

RHAGIONIDAE

Chrysopilus asiliformis (Preyssler, 1791)
Malaise trap, 7 – 20.v.1995 and 20 – 27.vii.1995.

TABANIDAE

(*Haematopota pluvialis* (Linnaeus, 1758))
Recorded for June in the 1961 – 1963 survey. It was commented that the species breeds in damp ground and probably would be able to do so by the lake. It is considered unlikely that this would be possible today and the species is apparently absent.

STRATIOMYIDAE

BERIDINAE

Beris chalybata (Forster, 1771)
Malaise trap, 9 – 23.v.1996.

Beris vallata (Forster, 1771)
Malaise trap, 20.v. – 23.vi.1995, 23 – 30.vi.1995.

Chorisops nagatomii Rozkošný, 1979
Malaise trap, 24 – 31.viii.1995, 22.ix. – 28.x.1995, 15.viii.- 5.ix.1996, 5.ix. – 21.x.1996.

Chorisops tibialis (Meigen, 1820)
Malaise trap, present in nine collections, May – September. Several at flowers in the Silver Garden on 5.vii.1996.

PACHYGASTRINAE

Eupachygaster tarsalis (Zetterstedt, 1842)
A scarce species last recorded in the Greater London area almost a hundred years ago in Blackheath. Malaise trap, 23 – 30.vi.1995.

Pachygaster atra (Panzer, [1798])
Malaise trap, present in ten collections, May – September. Commonly found by sweeping or beating bushes on The Mound and in The Border.

Pachygaster leachii Stephens in Curtis, 1824
Malaise trap, present in nine collections, May – August. Commonly found by sweeping or beating bushes on The Mound and in The Border.

SARGINAE

Chloromyia formosa (Scopoli, 1763)
Malaise trap, 23 – 30.vi.1995. Surprisingly scarce. Three females netted in the area of the Fire Hole on 5.vii.1996 is the only record outside the Malaise trap of this usually abundant soldier fly.

Microchrysa polita (Linnaeus, 1758)
Malaise trap, 23 – 30.vi.1995, 3 – 10.viii.1995.

Sargus bipunctatus (Scopoli, 1763)
Malaise trap, 20.x. – 20.xi.1995.

BOMBYLIIDAE

Bombylius major Linnaeus, 1758
Malaise trap, 27.iii. – 24.iv.1997. Scarce, but occasionally seen at flower borders in the spring.

THEREVIDAE

Thereva nobilitata (Fabricius, 1775)
Malaise trap, present in eight collections, May – August.

ASILIDAE

ASILINAE
Machimus atricapillus (Fallén, 1814)
Malaise trap, 20 – 27.viii.1995, 18.vii. – 13.viii.1997.

STENOPOGONINAE
Dioctria baumhaueri Meigen, 1820
Malaise trap, present in seven collections, May – August. 26.vi.1998 and in sweep net samples from The Mound.

HYBOTIDAE

Small any mainly predacious, the species recorded are generally widespread and common. *Platypalpus aristatus* and *P. incertus* were listed as Notable by Falk (1991) but will be removed from that category in a forthcoming review. *Drapetis setiger* is uncommon and *Platypalpus biapicalis*, is a rare species added to the British list in 1988 (Drake 1988).

HYBOTINAE
Hybos culiciformis (Fabricius, 1775)
Taken at various points throughout the garden on 13.viii.1997.
Hybos femoratus (Muller, 1776)
Malaise trap, 10 – 17.viii.1995.

OCYDROMINAE
Ocydromia glabricula (Fallén, 1816)
Taken in the wooded area on 1.x.1998.

TACHYDROMIINAE
Crossopalpus nigritellus (Zetterstedt, 1842)
Malaise trap, 20 – 28.vii.1995.
Drapetis ephippiata (Fallén, 1815)
Malaise trap, present in ten collections, April, July – September and 20.xii.95-23.ii.96.
Drapetis exilis (Meigen, 1822)
Malaise trap 7 – 20.v.1995, 7 – 22.ix.1995. and one on a plane tree trunk in area A, 31.x.1997.
Drapetis setiger (Loew, 1859)
Malaise trap, 10 – 17.viii.1995.
Platypalpus annulipes (Meigen, 1822)
Malaise trap, 18 – 27.vi.1996.
Platypalpus aristatus (Collin, 1926)
Malaise trap, 18 – 27.vi.1996.
Platypalpus biapicalis Weber, 1972
Malaise trap, 20 – 28.vii.1995.
Platypalpus calceatus (Meigen, 1822)
Malaise trap, 20 – 28.vii.1995.
Platypalpus incertus (Collin, 1926)
Malaise trap, present in five collections, May – July.
(*Platypalpus longicornis* (Meigen, 1822))

* *Platypalpus longiseta* (Zetterstedt, 1842)
Recorded in the 1961 – 1963 survey as *P.extricatus*. Malaise trap up to 7.vii.1995, 20 – 28.vii.1995.

Platypalpus minutus (Meigen) *or P. australominutus* Grootert
One female in area D on 13.viii.1997 cannot be identified beyond the level of this species pair.

Platypalpus pallidiventris (Meigen, 1822)
Malaise trap, 7 – 20.v.1995.

Platypalpus verralli (Collin, 1926)
Malaise trap, 7 – 20.v.1995.

Tachypeza nubila (Meigen, 1804)
Malaise trap 31.viii – 7.ix.1995, 7 – 22.ix.1995, 22.ix – 30.x.1995 and on Plane trunks, 21.x.96 and 13.viii.1997.

EMPIDIDAE

Commonly referred to as dance flies, *Hilara* in particular often forming huge swarms over water, all these species are widespread.

EMPIDINAE

Empis aestiva Loew, 1867
Malaise trap, 7 – 20.v.1995, up to 7.vii.1995, and D, on 26.vi.1998.

Empis albinervis Meigen, 1822
Malaise trap, 7 – 20.v.1995, 20-28.vii.1995, up to 7.vii.1995 and D on 26.vi.1998.

Empis nuntia Meigen, 1838
Malaise trap, 18 – 27.vi.1996.

* *Empis praevia* Collin, 1927
Malaise trap, 23.v. – 6.vi.1996.

Empis tessellata Fabricius, 1794
Malaise trap, 23.v. – 6.vi.1996.

Empis tumida Meigen, 1822
Malaise trap, 20 – 28.vii.1995. 5.vii.1996, Silver Garden.

Hilara brevistyla Collin 1927
Malaise trap, 25.iv. – 9.v.1996.

(Hilara flavipes Meigen, 1822)

Hilara fuscipes (Fabricius, 1794)
Malaise trap, 7 – 20.v.1995, up to 30.vi.1995, up to 7.vii.1995 and D on 26.vi.1998.

Hilara griseifrons Collin 1927
Malaise trap, present in four collections, May – August.

Hilara manicata Meigen, 1822
Malaise trap, 7 – 20.v.1995.

Hilara monedula Collin, 1927
B (males) and D (female) on 26.vi.1998.

Hilara obscura Meigen, 1822
A and B, numerous on 26.vi.1998 and B on 13.viii.1997.

Rhamphomyia erythropthalma Meigen, 1830
Malaise trap, 7 – 22.ix.1995, 22.ix – 20.x.1996 and areas A and D on 1.x.1998.

Rhamphomyia gibba (Fallén, 1816)
Malaise trap, 3-10.viii.1995, 10-17.viii.1995, 18.vii-13.viii.1997. 13.viii.1997 B.

Rhamphomyia nigripennis (Fabricius, 1794)
B, on 26.vi.1998.

Rhamphomyia tarsata Meigen, 1822
Malaise trap, up to 7.vii.1995, and D on 26.vi.1998.

HEMERODROMIINAE

(Hemerodromia raptoria Meigen, 1830)

DOLICHOPODIDAE

Mostly predatory species often with striking metallic coloration and or leg adornments. All these species are common and widespread.

DIAPHORINAE

Argyra argyria (Meigen, 1824)
B, on 26.vi.1998.

Chrysotus cupreus (Macquart, 1827)
Malaise trap, 20 – 28.vii.1995.

Chrysotus gramineus (Fallén, 1823)
Malaise trap, 7 – 20.v.1995 and B on 26.vi.1998.

DOLICHOPODINAE

Dolichopus griseipennis Stannius, 1831
Malaise trap, present in seven collections, June, July – September. 13.viii.1997 A B.

Dolichopus ungulatus (Linnaeus, 1758)
Malaise trap, 7 – 20.v.1995, up to 30.vi.1995, up to 7.vii.1995, 20-28.vii.1995. Also in the Silver Garden, 5.vii.1996 and areas B (26.vi.1998) and C (13.viii.1997).

Poecilobothrus nobilitatus (Linnaeus, 1767)
Malaise trap, up to 30.vi.1995, 7 – 20.v.1995. 26.vi.1998 B numerous.

HYDROPHORINAE

Hydrophorus litoreus Fallén, 1823
15.vi.1995, light trap.

MEDETERINAE

* *Medetera jacula* (Fallén, 1823)
Malaise trap, present in five collections, May, July, August.

Medetera truncorum Meigen, 1824
Malaise trap, present in four collections, July, August. Also areas A and B on 26.vi.1998 and B (on tree trunks) on 13.viii.1997.

SCIAPODINAE

Sciapus wiedemanni (Fallén, 1823)
Malaise trap, 20 – 28.vii.1995.

Sciapus platypterus (Fabricius, 1805)
Malaise trap, present in five collections, May – August and also in A, B and D on 26.vi.1998, mostly on tree trunks.

SYMPYCNINAE

Anepsiomyia flaviventris (Meigen, 1824)
Area D, on 26.vi.1998.

Campsicnemus curvipes (Fallén, 1823)
Area A, on 19.x.1998, and Area D, on31.x.1997.

* *Sympycnus desoutteri* Parent, 1925
Areas A, B, C and D on 13.viii.1997.

Syntormon denticulatum (Zetterstedt, 1843)
Area B, on 31.x.1997, 26.vi.1998 and 1.x.1998.

(Syntormon pallipes (Fabricius, 1794))

PLATYPEZIDAE

The six species recorded are all fungus feeders as larvae. The *Agathomyia* and *Polyporivora* species develop in bracket fungi, *Lindneromyia* in field mushrooms (*Agaricus* species) and the species of *Platypeza* and *Protoclythia* in the honey fungus *Armillaria mellea*, on which they were recorded. All are widespread except *A. falleni*, which is local and confined to the south-east of England.

CALLOMYIINAE

Agathomyia antennata (Zetterstedt, 1819)
Area A, 1.x.1998.

Agathomyia falleni (Zetterstedt, 1819)
Malaise trap, 22.ix – 20.x.1996 and a female on hazel foliage near Malaise trapon 1.x.1998.

PLATYPEZINAE

Lindneromyia dorsalis (Meigen, 1804)
Malaise trap, 7 – 22.ix.1995.

Platypeza consobrina Zetterstedt, 1844
1.x.1998. on *Armillaria mellea*, and one in area A on 19.x.1998.

Polyporivora picta (Meigen, 1830)
Malaise trap, 21.x – 28.xi.1996, 18.vii – 13.viii.1997.

Protoclythia rufa (Meigen, 1830)
Malaise trap, 22.ix – 20.x.1996, 20.x – 20.xi.1996 and one on fungus *Armillaria mellea* in area A on1.x.1998.

PHORIDAE

Anevrina thoracica (Meigen, 1804) *Conicera dauci* (Meigen, 1830)
C. similis (Haliday, 1833)
Diplonevra funebris (Meigen, 1830)
D. nitidula (Meigen, 1830)
D. pilosella Schmitz, 1927
Dohrniphora cornuta (Bigot, 1857)
Gymnoptera vitripennis (Meigen, 1830)
Megaselia aculeata (Schmitz, 1919) *M. aequalis* (Wood, 1909)
M. albicaudata (Wood, 1910)
M. altifrons (Wood, 1909)
M. angusta (Wood, 1909)
M. basispinata (Lundbeck, 1920)
M. berndseni (Schmitz, 1919)
M. bovista (Gimmerthal, 1848)
M. brevicostalis (Wood, 1910)
M. ciliata (Zetterstedt, 1848)
M. cinereifrons (Strobl, 1910)
M. clemonsi Disney, 1984
M. consetigera (Schmitz, 1925)
M. densior Schmitz, 1927
M. devia Schmitz, 1936
M. drakei Disney, 1984
M. emarginata (Wood, 1908)
M. errata (Wood, 1912)
M. feshiensis Disney, 1987
M. flava (Fallén, 1823)
M. frameata Schmitz, 1927
M. giraudii (Egger, 1862)
M. gregaria (Wood, 1910)
M. hendersoni Disney, 1979
M. hirtiventris (Wood, 1909)
M. ignobilis (Schmitz, 1919)

M. infraposita (Wood, 1909)
M. latior Schmitz, 1936
M. longicostalis (Wood, 1912)
M. manicata (Wood, 1910)
M. marklanei Disney, 2001
M. meconicera (Speiser, 1925)
M. minor (Zetterstedt, 1848)
M. nigra (Meigen, 1830)
M. nigriceps (Loew, 1866)
M. paludosa (Wood, 1908)
M. pectoralis (Wood, 1910)
M. pleuralis (Wood, 1909)
M. plurispinulosa (Zetterstedt, 1860)
M. propinqua (Wood, 1909)
M. pumila (Meigen, 1830)
M. pusilla (Meigen, 1830)
M. quadriseta (Schmitz, 1918)
M. rubella (Schmitz, 1920)
M. ruficornis (Meigen, 1830)
M. rufipes (Meigen, 1804)
M. spinicincta (Wood, 1910)
M. stichata (Lundbeck, 1920)
M. stigmatica (Schmitz, 1920)
M. subcarpalis (Lundbeck, 1920)
M. subpleuralis (Wood, 1909)
M. sulphuripes (Meigen, 1830)
M. superciliata (Wood, 1910)
M. surdifrons (Wood, 1909)
M. sylvatica (Wood, 1910)
M. tarsalis (Wood, 1910)
Metopina galeata (Haliday, 1833)
M. oligoneura (Mik, 1867)
M. pileata Schmitz, 1936
M. ulrichi Disney, 1979
Phalacrotophora fasciata (Fallén, 1823) **Phora atra* (Meigen, 1804)
Recorded in the 1961 – 1963 survey as *P. aterrima.*
P. holosericea Schmitz, 1920
Pseudacteon formicarum (Verrall, 1877)
Spiniphora bergenstammi (Mik, 1864)
Triphleba distinguenda (Strobl, 1892)
T. nudipalpis (Becker, 1901)

LONCHOPTERIDAE
* *Lonchoptera lutea* Panzer, 1809
Malaise trap, present in four collections, July – October. 1.x.1998 A, 19.x.1998 A.

SYRPHIDAE
SYRPHINAE
BACCHINI
Baccha elongata (Fabricius, 1775)
Melanostoma mellinum (Linnaeus, 1758)

Melanostoma scalare (Fabricius, 1794)
* *Platycheirus albimanus* (Fabricius, 1781)
(*Platycheirus clypeatus* agg.)
Platycheirus scutatus (Meigen, 1822)
Platycheirus rosarum (Fabricius, 1787)

SYRPHINI
Chrysotoxum bicinctum (Linnaeus, 1758)
Dasysyrphus albostriatus (Fallén, 1817)
Dasysyrphus venustus (Meigen, 1822)
Epistrophe eligans (Harris, [1780])
* *Episyrphus balteatus* (De Geer, 1776)
Eupeodes corollae (Fabricius, 1794)
Eupeodes luniger (Meigen, 1822)
Meligramma trianguliferum (Zetterstedt, 1843)
* *Meliscaeva auricollis* (Meigen, 1822)
Scaeva pyrastri (Linnaeus, 1758)
(*Sphaerophoria rueppellii* (Wiedemann, 1830))
Sphaerophoria scripta (Linnaeus, 1758)
* *Syrphus ribesii* (Linnaeus, 1758)
Syrphus torvus Osten Sacken, 1875
Syrphus vitripennis Meigen, 1822
Xanthogramma pedissequum (Harris, [1776])

MILESIINAE
CHEILOSIINI
Cheilosia pagana (Meigen, 1822)

CHRYSOGASTRINI
Neoascia podagrica (Fabricius, 1775)

ERISTALINI
Eristalis (Eoseristalis) intricarius (Linnaeus, 1758)
* *Eristalis (Eristalis) tenax* (Linnaeus, 1758)
Helophilus pendulus (Linnaeus, 1758)
Myathropa florea (Linnaeus, 1758)

MERODONTINI
Eumerus ornatus Meigen, 1822
Eumerus strigatus (Fallén, 1817)
Eumerus funeralis Meigen, 1822 (= tuberculatus Rondani, 1857)
Merodon equestris (Fabricius, 1794)

PIPIZINI
Heringia (Neocnemodon) vitripennis (Meigen, 1822)

VOLUCELLINI
Volucella inanis (Linnaeus, 1758)
Volucella pellucens (Linnaeus, 1758)
Volucella zonaria (Poda, 1761)

XYLOTINI
Syritta pipiens (Linnaeus, 1758)
Xylota segnis (Linnaeus, 1758)

PIPUNCULIDAE

CHALARINAE

* *Chalarus spurius* (Fallén, 1816)
Recorded as "*spurius* agg" in the 1961 – 1963 survey.

PIPUNCULINAE

Cephalops ultimus (Becker, 1900)
Malaise trap, 30.vi.1995, 18.viim– 13.viii.1995.

Eudorylas obliquus Coe, 1966
Malaise trap, present in five collections, June, July, September – November. Swept in area D on 1.x.1998.

Pipunculus campestris Latreille, 1802
Malaise trap, 31.viii. – 7.ix.1995 and area A on 26.vi.1998.

PSILIDAE

Both recorded species are common and widespread. *Chamaepsila rosae*, the carrot fly, is a significant pest.

PSILINAE

Psila merdaria Collin, 1944
Malaise trap, 23.v. – 6.vi.1996, 15.v. – 19.vi.1997.

Chamaepsila rosae (Fabricius, 1794)
A male on the island on 13.viii.1997 and a probable female in arca A on 31.x.1997.

LONCHAEIDAE

Small, shiny blue/black insects, larvae often found beneath the bark of trees. *Lonchaea palposa* is listed as Notable by Falk (1991).

LONCHAEINAE

Lonchaea chorea (Fabricius, 1781)
Areas A, B and D on 26.vi.1998 and rea B on 1.x.1998.

Lonchaea laticornis Meigen, 1826
One female in D on 26.vi.1998.

Lonchaea palposa Zetterstedt, 1847
Malaise trap, 17 – 24.viii.1995.

Protearomyia nigra (Meigen, 1826)
Malaise trap, 18 – 27.vi.1996.

Setisquamalonchaea fumosa (Egger, 1862)
Malaise trap, present in seven collections, May – September. On dead wood of *Robinia* trunk in area B on13.viii.1997.

PALLOPTERIDAE

One of the smaller families of picture winged flies, all widespread species.

PALLOPTERINAE

Palloptera muliebris (Harris, [1780])
Malaise trap, present in six collections, May, August – October.

Palloptera umbellatorum (Fabricius, 1775)
Malaise trap, present in eight collections, May – October. Also in areas A and D on 26.vi.1998, area C on 13.viii.1997 and area B on 1.x.1998.

Palloptera ustulata Fallén, 1820
Malaise trap, 7 – 22.ix.1995.

PIOPHILIDAE

Both recorded species are common and widespread.

PIOPHILINAE

Liopiophila varipes (Meigen, 1830)

Area A, on13.viii.1997.

* *Parapiophila vulgaris* (Fallén, 1820)

Area D, on 1.x.1998, attracted in large numbers by decomposing contents of Malaise trap bottle.

Ulidiidae

Otitinae

Seioptera vibrans (Linnaeus, 1758)

Malaise trap, 15.v – 19.vi.1997.

Tephritidae

The picture-winged flies. None of these records are surprising.

TEPHRITINAE

Chaetostomella cylindrica (Robineau-Desvoidy, 1830)

Area B, on 26.vi.1998.

Tephritis formosa (Loew, 1844)

Malaise trap, up to 30.vi.1995 and area D on 13.viii.1997.

Tephritis vespertina (Loew, 1844)

Silver Garden, 5.vii.1996 and area D on 31.x.1997.

(*Urophora cardui* (Linnaeus, 1758))

Xyphosia miliaria (Schrank, 1781)

Malaise trap, present in four collections, May – August.

TRYPETINAE

Trypeta zoe Meigen, 1826

Malaise trap, 20 – 28.vii.1995, 7 – 22.ix.1995 and areas B and C on 1.x.1998.

LAUXANIIDAE

Mainly woodland species, many are known to develop in decaying vegetation. Three species listed here *Homoneura tesque, Aulagastromyia anisodactyla* and *Sapromyza quadricincta* are categorised by Falk (1991) as Notable, although *A. anisodactyla* is recorded from nine sites in south-west Essex and East London.

HOMONEURINAE

Homoneura patelliformis (Becker, 1895)

Malaise trap, 7 – 20.v.1995, up to 7.vii.1995. Silver Garden, 5.vii.1996. Two males in area D on 26.vi.1998. .

Homoneura tesquae (Becker, 1895)

Malaise trap, 3 – 10.viii.1995.

Homoneura tesquae (Becker, 1895) or *christophi* (Becker, 1895)

One female in D on 13.viii.1997.

LAUXANIINAE

Aulagastromyia anisodactyla (Loew, 1845)

Malaise trap, present in five collections, July – September and in D on 13.viii.1997 and 26.vi.1998.

Calliopum aeneum (Fallén, 1820)

Area D on 26.vi.1998 and areas B and D on 13.viii.1997.

Calliopum simillimum (Collin, 1933)

Malaise trap, 31.viii – 7.ix.1995, 7 – 22.ix.1995, 21.x. – 28.xi.1996. Also in area B on 1.x.1998.

Meiosimyza decempunctata (Fallén, 1820)

Malaise trap, 7 – 20.v.1995.

Meiosimyza rorida (Fallén, 1820)
Malaise trap, 27.vii – 3.viii.1995. Area D on 13.viii.1997 and 26.vi.1998.

Pseudolyciella stylata Papp, 1978
Malaise trap, up to 30.vi.1995.

Minettia inusta (Meigen, 1826)
Malaise trap, present in five collections, May, July, August. Also in areas B and C on 13.viii.1997 and one on a plane trunk in area A on 26.vi.1998.

Minettia longipennis (Fabricius, 1794)
Malaise trap, up to 30.vi.1995.

Minettia lupulina (Fabricius, 1787)
Silver Garden, 5.vii.1996 and aread D on 13.viii.1997.

Minettia rivosa (Meigen, 1826)
Malaise trap, present in eight collections, May – September. Silver Garden, 5.vii.1996, area D on 13.viii.1997 and in areas B and D on 26.vi.1998.

Sapromyza quadricincta Becker, 1895
Malaise trap, 20 – 28.vii.1995.

Sapromyza quadripunctata (Linnaeus, 1767)
Malaise trap, 3 – 10.viii.1995, 31.viii – 7.ix.1995, 18-27.vi.1996.

Sapromyza halidayi Shatalkin, 2000 (=*sordida* Haliday, 1833, preocc)
Malaise trap, present in nine collections, May – November. Also in the Silver Garden on 5.vii.1996, areas A, C and D on 13.viii.1997, area B on 31.x.1997, area D on 26.vi.1998 and areas Band D on 1.x.1998.

Tricholauxania praeusta (Fallén, 1820)
Malaise trap, 20 – 28.vii.1995, 3 – 10.viii.1995, 7 – 22.ix.1995. Also in area D on 26.vi.1998.

CHAMAEMYIIDAE

The larvae are predators of aphids and coccids.

CHAMAEMYIINAE

Chamaemyia polystigma (Meigen, 1830)
Malaise trap, 10 – 17.viii.1995. In grassy area on The Mound on 13.viii.1997.

(*Leucopis puncticornis* Meigen, 1830)

DRYOMYZIDAE

Not uncommon; has been reared from dung.

Dryomyza flaveola (Fabricius, 1794)
Area A on 13.viii.1997.

SCIOMYZIDAE

Sciomyzid larvae feed on terrestrial or aquatic molluscs. *Sepedon* is a predator of aquatic molluscs, but the larval habits of *Trypetoptera*, which is often found in woodland, are unknown.

SCIOMYZINAE

Sepedon sphegea (Fabricius, 1775)
Area C on 13.viii.1997 and 1.x.1998.

Trypetoptera punctulata (Scopoli, 1763)
Malaise trap, 20-28.vii.1995 and in aread D on 13.viii.1997 and 26.vi.1998.

SEPSIDAE

All these species develop in various animal faeces; *Themira superba* is the most noteworthy amongst a group of widespread species.

Nemopoda nitidula (Fallén, 1820)
Area B on 1.x.1998.

Sepsis cynipsea (Linnaeus, 1758)
Malaise trap, 7 – 20.v.1995.

Sepsis fulgens Meigen, 1826
Malaise trap, 31.viii. – 7.ix.1995, 7 – 22.ix.1995, 22.ix. – 20.x.1996. Also in area A on 31.x.1997 and area D on 13.viii.1997.

Sepsis orthocnemis Frey, 1908
Malaise trap, 20 – 28.vii.1995. Area D on 13.viii.1997.

Sepsis punctum (Fabricius, 1794)
Area A on 13.viii.1997 and 31.x.1997.

Sepsis violacea Meigen, 1826
Malaise trap, 25.iv. – 9.v.1996.

Themira annulipes (Meigen, 1826)
Area B on 26.vi.1998.

Themira lucida (Staeger, 1844)
Area B on 26.vi.1998 and areas B and C on 13.viii.1997.

Themira superba (Haliday, 1833)
Area A on26.vi.1998.

CLUSIIDAE

Two common species whose larvae develop in dead wood.

Clusiodes albimanus (Meigen, 1830)
Malaise trap, 7 – 20.v.1995, 7 – 22.ix.1995, 21.x.1996.

Clusiodes gentilis (Collin 1912)
Malaise trap, 7 – 22.ix.1995.

ODINIIDAE

Probably the most frequently encountered member of the genus, I have collected it regularly on fungi on old Beech trees.

Odinia boletina (Zetterstedt, 1848)
Malaise trap, 7 – 20.v.1995.

AGROMYZIDAE

All agromyzids are plant feeders; about seventy five percent are leaf miners, the rest feeding in stems or roots.

AGROMYZINAE

(*Agromyza alnibetulae* Hendel, 1931)

(*Agromyza demeijerei* Hendel, 1920)

Agromyza flavipennis Hendel, 1920
Malaise trap, 25.iv. – 9.v.1996.

Agromyza mobilis Meigen, 1830
Malaise trap, 7 – 20.v.1995.

(*Agromyza nigripes* Meigen, 1830)

Agromyza nigrociliata Hendel, 1931
Malaise trap, 25.iv. –.v.1996.

Agromyza reptans Fallén, 1823
Area B on 26.vi.1998.

PHYTOMYZINAE

Cerodontha biseta (Hendel, 1920)
Malaise trap, up to 7.vii.1995. Area D on 26.vi.1998.

(*Cerodontha denticornis* (Panzer, [1806]))

Cerodontha fulvipes (Meigen, 1830)
Area D on 13.viii.1997.

Cerodontha iraeos (Robineau-Desvoidy, 1851)
Mines in *Iris pseudacorus*, 1997/8
(Cerodontha pygmaea (Meigen, 1830))
Recorded in the 1961 – 1963 survey as *Poemyza pygmaea* (R-D)
(Chromatomyia horticola (Goureau, 1851))
Recorded in the 1961 – 1963 survey as *Phytomyza atricornis.*
Chromatomyia milii (Kaltenbach 1864)
Malaise trap, 7 – 20.v.1995. Areas A and B on 26.vi.1998.
(Liriomyza centaureae Hering, 1927*)*
(Liriomyza congesta (Becker, 1903))
Liriomyza demeijerei Hering, 1930
Malaise trap, 20 – 28.vii.1995.
Liriomyza flaveola (Fallén, 1823)
Area A on 31.x.1997.
(Liriomyza strigata (Meigen, 1830))
Napomyza lateralis (Fallen, 1823)
Malaise trap, 22.ix. – 20.x.1995.
(Phytomyza aconiti Hendel, 1920)
(Phytomyza affinis Fallen, 1823)
Phytomyza aquilegiae Hardy, 1849.
Mines on *Aquilegia* 1997/8.
* *Phytomyza chaerophylli* Kaltenbach 1856
Recorded in the 1961 – 1963 survey as *Phytomyza anthrisci.* Malaise trap, 18 – 27.vi.1996.
(Phytomyza cytisi Brischke, 1881*)*
* *Phytomyza ilicis* Curtis, 1846
Mines on various dates.
(Phytomyza lappae Goureau, 1851*)*
Recorded in the 1961 – 1963 survey as *Phytomyza lappinae.*
Phytomyza pastinacae Hendel
Area B on 13.viii.1997.
Phytomyza ranunculi (Schrank, 1803)
Malaise trap, up to 7.vii.1995, 20 – 28.vii.1995.
(Phytomyza spondylii Robineau-Desvoidy*).*
Recorded in the 1961 – 1963 survey as *P. sphondylii.*

OPOMYZIDAE
These three species are all common. The larvae develop in grasses and cereals.
Geomyza tripunctata Fallen, 1823
Malaise trap, 10 – 17.viii.1995, 17 – 24.viii.1995, 7 – 22.ix.1995. 28.iii. – 11.iv.1996.
Opomyza florum (Fabricius, 1794)
Malaise trap, present in four collections, August – November. Areas A, C and D on 13.viii.1997 and area A on 31.x.1997 and 1.x.1998.
Opomyza germinationis (Linnaeus, 1758)
Malaise trap, present in ten collections, May – October. Silver Garden area, 5.vii.1996. Also in area D on 13.viii.1997, areas A and D on 26.vi.1998 and in area B on 1.x.1998.

PERISCELIDAE
A Nationally Notable species strongly associated with sap runs.
Periscelis annulata (Fallén, 1813)
Malaise trap, 20.v – 19.vi.1997.

ASTEIIDAE
Two widespread species; *Leiomyza* has been reared from fungi.
Asteia amoena Meigen, 1830
Malaise trap, up to 7.vii.1995, 20 – 28.vii.95, >21.x.96, 18.vii – 13.viii.1997.

Leiomyza laevigata (Meigen, 1830)
Malaise trap, 18 – 27.vi.1996, up to 7.vii.1995. >21.x.96, 18.vii. – 13.viii.1997.

CARNIDAE

Tiny flies, many members of the genus Meoneura have been reared from birds' nests, whilst adults can often be found in numbers on flowers.

Meoneura minutissima (Zetterstedt, 1860)
Malaise trap, 10 – 17.viii.1995.

CHLOROPIDAE

A large family, primarily plant feeders but with a diverse range of larval habits. The species listed here are mostly widespread and most are grass or cereal feeders and some are significent agricultural pests. Both the *Tricimba* species have been reared from fungi. *Chlorops planifrons, Elachiptera austriaca,* and *Oscinimorpha arcuata* are all Notable.

CHLOROPINAE

Cetema elongatum (Meigen, 1830)
Malaise trap, 20 – 28.vii.1995.

Cetema neglectum Tonnoir, 1921
Malaise trap, 20 – 28.vii.1995.

Chlorops planifrons (Loew, 1866)
In grassy area on The Mound on 13.viii.1997.

Meromyza femorata Macquart, 1835
Malaise trap, 20 – 28.vii.1995. In grassy area on The Mound on 13.viii.1997..

Thaumatomyia glabra (Meigen, 1830)
Malaise trap, present in five collections, May, July, August.

Thaumatomyia hallandica Andersson 1966
Malaise trap, up to 7.vii.1995.

* *Thaumatomyia notata* (Meigen, 1830)
Malaise trap, present in five collections, April- July, September. Silver Garden area, 5.vii.1996. Area C on 13.viii.1997, area A on 31.x.1997 and area D on 26.vi.1998.

OSCINELLINAE

Conioscinella frontella (Fallén, 1820)
Malaise trap, 7 – 20.v.1995, 18 – 27.vi.1996.

* *C. mimula* Collin, 1946
Malaise trap, up to 7.vii.1996.

Elachiptera cornuta (Fallén, 1820)
Malaise trap, 7 – 20.v.1995, 20 – 28.vii.1995. Area A on 13.viii.1997 and area B on 31.x.1997.

Elachiptera austriaca Duda, 1932
Area B on 31.x.1997.

Gaurax fascipes Becker, 1910
Malaise trap, present in six collections, May – July, August.

* *Oscinella frit* (Linnaeus, 1758)
Recorded in the 1961 – 1963 survey as "the form that mines *Anthoxanthum*" Malaise trap, 10 – 17.viii.1995, 17 – 24.viii.1995.

Oscinella hortensis Collin, 1946
Malaise trap, 10 – 17.viii.1995.

Oscinella maura (Fallén, 1820)
13.viii.1997 near waterfall.

Oscinella nitidissima (Meigen, 1838)
Malaise trap, 10 – 17.viii.1995.

Oscinimorpha arcuata (Duda, 1932)
Malaise trap, 10 – 17.viii.1995, up to 7.vii.1996.

Tricimba cincta (Meigen, 1830)
Malaise trap, 27.vii. – 3.viii.1995, 10 – 17.viii.1995, 31.viii. – 7.ix.1995. Asrea D on 13.viii.1997 and 26.vi.1998.

Tricimba lineella (Fallén, 1820)
Malaise trap, 10 – 17.viii.1995.

HELEOMYZIDAE

Larvae in animal burrows or birds' nests and *Suillia* in particular in fungi. The two *Trixoscelis* species have both been reared from birds' nests. None of the species listed are particularly noteworthy.

HELEOMYZINAE

Oecothea praecox Loew, 1862
Malaise trap, 27.vii. – 3.viii.1995.

HETEROMYZINAE

Heteromyza rotundicornis (Zetterstedt, 1846)
Area B on 31.x.1997 and 1.x.1998.

Tephrochlaemys flavipes (Zetterstedt, [1838])
Malaise trap, 22.ix. – 20.x.1995. Also in area A on 26.vi.1998 and aread D on 1.x.1998.

Tephrochlaemys rufiventris (Meigen, 1830)
Malaise trap, 7 – 22.ix.1995, 21.x. – 28.xi.1996. Area A on 26.vi.1998, areas A and B on 31.x.1997 and 19.x.1998 and in areas B and D on 1.x.1998.

Tephrochlaemys tarsalis (Zetterstedt, 1847)
Malaise trap, 21.x. – 28.xi.1996.

SUILLINAE

Suillia affinis (Meigen, 1830)
Malaise trap, 7 – 22.ix.1995, 25.iv. – 9.v.1996, 15.v. – 19.vi.1997. Areas A and D on 26.vi.1998, area A on 1.x.1998 and area B on 19.x.1998.

Suillia bicolor (Zetterstedt, [1838])
Malaise trap, 21.x. – 28.xi.1996. Areas A and B on 31.x.1997, area A on 1.x.1998 and area B on 19.x.1998.

Suillia notata (Meigen, 1830)
Areas A and B on 31.x.1997.

Suillia pallida (Fallén, 1820)
In area D on 13.viii.1997 and area B on 1.x.1998.

Suillia ustulata (Meigen, 1830)
Malaise trap, 20 – 28.vii.1995.

Suillia variegata (Loew, 1862)
Malaise trap, present in five collections, May, June, August – October. Area C on 13.viii.1997, area D on 26.vi.1998 and area A on 31.x.1997, 1.x.1998 and 19.x.1998.

TRIXOSCELIDINAE

Trixoscelis frontalis (Fallén, 1823)
In areas A, B and D on 26.vi.1998 and area D on 13.viii.1997 and 31.x.1997, frequent on the latter date.

Trixoscelis similis Hackman, 1970
Malaise, 16.v. – 19.vi.1997. A male in area A on 26.vi.1998.

CHYROMYIDAE

This species has been reared from birds nests.

Gymnochiromyia inermis (Collin, 1933)
Malaise trap, 3 – 10.viii.1995.

SPHAEROCERIDAE

A large family represented in Britain by about one hundred and forty species. They are found in a very wide range of habitats, animal burrows, seaweed, wet mud, dung, fungi, etc. The species listed here are all common, apart from *Apteromyia claviventris* and *Pseudocollinella septentrionalis*, which have a more restricted distribution.

COPROMYZINAE
Lotophila atra (Meigen, 1830)
Area D on 26.vi.1998.
Copromyza stercoraria (Meigen, 1830)
Malaise trap, 31.viii. – 7.ix.1995.

LIMOSININAE
Apteromyia claviventris (Strobl, 1909)
Area D on 1.x.1998.
Chaetopodella scutellaris (Haliday, 1836)
Malaise trap, 20 – 28.vii.1995, 10 – 17.viii.1995.
Coproica acutangula (Zetterstedt, 1847)
Malaise trap, 7 – 20.v.1995.
Coproica ferruginata (Stenhammar, 1855)
Area A on 26.vi.1998 and around the compost heap on 31.x.1997.
Coproica vagans (Haliday, 1833)
Around compost heap area on 31.x.1997.
Leptocera fontinalis (Fallén, 1826)
Malaise trap, 7 – 20.v.1995, 25.iv. – 9.v.1996.
Leptocera caenosa (Rondani, 1880)
Area B on 26.vi.1998.
Leptocera nigra Olivier, 1813
Area A on 13.viii.1997 and area D on 31.x.1997.
* *Leptocera limosa* (Fallén, 1820)
Area A on 31.x.1997.
Leptocera lutosa (Stenhammar, 1855)
Area A on 19.x.1998.
(*Leptocera lutosoidea* (Duda, 1938))
* *Limosina silvatica* (Meigen, 1830)
Area A on 31.x.1997.
(*Opacifrons coxata* (Stenhammar, 1855))
Recorded in the 1961 – 1963 survey as *Leptocera coxata*.
(*Pseudocollinella humida* (Haliday 1836))
Recorded in the 1961 – 1963 survey as *Leptocera humida*.
Pseudocollinella septentrionalis (Stenhammar, 1855)
Area A on 1.x.1998.
Pteremis fenestralis (Fallén, 1820)
Area C on 13.viii.1997.
Pullimosina heteroneura (Haliday, 1836)
Malaise trap, 7 – 20.v.1995, 31.viii. – 7.ix.1995.
Pullimosina moesta (Villeneuve, 1918)
Malaise trap, 7 – 20.v.1995.
Spelobia bifrons (Stenhammar, 1855)
One male around compost area 31.x.1997.
Spelobia clunipes (Meigen, 1830)
Malaise trap, up to 7.vii.1995. Area A on 31.x.1997 and abundant around compost heap area, 26.vi.1998.
Spelobia palmata (Richards, 1927)
Malaise trap, 3 – 10.viii.1995.
Spelobia talparum (Richards, 1927)
Malaise trap, 7 – 20.v.1995.

SPHAEROCERINAE

Ischiolepta denticulata (Meigen, 1830)
Malaise trap, 10 – 17.viii.1995.

Ischiolepta pusilla (Fallén, 1820)
Around compost area, 26.vi.1998.

DROSOPHILIDAE

The family is well known for its association with decaying and fermenting fruits, many of these *Drosophila* species could be found around any English garden compost heap. *Drosophila histrio, D. phalerata, D. obscura* and D. *subobscura* have been reared from fungi. *Stegana similis* is a southern woodland species associated with rotten wood and the three species of *Scaptomyza* are common leaf miners.

DROSOPHILINAE

Chymomyza fuscimana (Zetterstedt, [1838])
Malaise trap, 21.x.1996.

Drosophila andalusiaca Strobl, 1906
Areas B and D on 1.x.1998.

Drosophila histrio Meigen, 1830
Area C, 19.x.1998 (reared *ex* decaying fungus, emerged later in October)

Drosophila immigrans Sturtevant, 1921
Area A on 31.x.1997.

Drosophila phalerata Meigen, 1830
A female on ash of old bonfire site, 26.vi.1998.

Drosophila hydei Sturtevant, 1921
Malaise trap, 20 – 28.vii.1995.

Drosophila melanogaster Meigen, 1830
Area A on 1.x.1998.

Drosophila obscura Fallén, 1823
Malaise trap, up to 7.vii.1995, 20 – 28.vii.1995.

Drosophila subobscura Collin, 1936
Malaise trap, present in five collections, May, July – September. Females in area B on 26.vi.1998.

Scaptomyza flava (Fallen, 1830)
Malaise trap, up to 7.vii.1995. Areas B and D on 26.vi.1998 and areas A and B on 31.x.1997.

* *Scaptomyza graminum* (Fallén, 1823)
Recorded in the 1961 – 1963 survey as *Drosophila graminum.* Area A on 26.vi.1998 and near the waterfall on 13.viii.1997.

* *Scaptomyza pallida* (Zetterstedt, 1847)
Recorded in the 1961 – 1963 survey as *Drosophila disticha.* Malaise trap, present in seven collections, May, July – September. Area A on 1.x.1998.

STEGANINAE

Stegana similis Laŝtovka & Máca, 1982
Malaise trap, 7 – 20.v.1995, 31.viii. – 7.ix.1995.

DIASTATIDAE

A woodland species, widespread.

Diastata costata Meigen, 1830
Area B on 1.x.1998.

CAMPICHOETIDAE

Mainly a southern woodland species.

Campichoeta punctum (Meigen, 1830)
Area D on 13.viii.1997 and area A on 1.x.1998.

CAMILLIDAE

These four species are widespread, they are associated with mammal burrows and in some cases the nests of waterfowl.

Camilla atrimana Strobl, 1910
Males and females in area D on 13.viii.1997.

Camilla flavicauda Duda, 1922
Malaise trap, 18 – 27.vi.1996.

Camilla glabra (Fallén, 1823) (= *subfuscipes* Collin, 1937)
A male in area D on 26.vi.1998.

Camilla nigrifrons Collin, 1933
Malaise trap, present in four collections, May, July, August. A female in area B on 26.vi.1998.

EPHYDRIDAE

The larvae of this family are not well known, but most share an aquatic or semi-aquatic habitat. *Hydrellia* are phytophagous. None of these species is noteworthy.

EPHYDRINAE

* *Limnellia quadrata* (Fallén, 1813)
Area A on 13.viii.1997, area D on 31.x.1997 and aread B on 1.x.1998.

* *Parydra coarctata* (Fallén, 1813)
Area B on 26.vi.1998.

(*Scatella stagnalis* (Fallén, 1813))

Scatella tenuicosta Collin, 1930
Area A on 26.vi.1998 and area C on 13.viii.1997.

Scatophila cribrata (Stenhammar, 1844)
Area A on 26.vi.1998.

Discocerina obscurella (Fallén, 1813)
Area B on 26.vi.1998 and 13.viii.1997; area D on 31.x.1997.

Ditrichophora calceata (Meigen, 1830)
Area B on 26.vi.1998 and areas A, B and D on 1.x.1998.

HYDRELLIINAE

* *Hydrellia griseola* (Fallén, 1813)
Malaise trap, 7 – 20.v.1995. Areas A, B and D on 13.viii.1997.

* *Hydrellia maura* Meigen, 1838 (= *modesta* Loew, 1860)
Recorded in the 1961 – 1963 survey as *H. incana*. Area A on 26.vi.1998 and areas A and B on 31.x.1997.

(*Notiphila cinerea* Fallén, 1813)

ILYTHEINAE

Philygria stictica (Meigen, 1830)
Malaise trap, up to 30.vi.1995.

SCATHOPHAGIDAE

Apart from *Norellia* these are all common species. *Norellia spinipes* was only recently added to the British list (Chandler & Stubbs 1969) from Surrey and Bucks. Since then it has become more widespread, and I have taken it several times in my garden in Essex. It has been reared from Daffodils (*Narcissus* spp.) and may well have been imported with Daffodil bulbs,

SCATHOPHAGINAE

Nanna fasciata (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.

Nanna inermis (Becker, 1894)
Malaise trap, 25.iv. – 9.v.1996.

Norellia spinipes (Meigen, 1826)
Malaise trap, 27.vii. – 3.viii.1995. Area D on 31.x.1997.
Norellisoma spinimanum (Fallén, 1819)
Malaise trap, 25.iv. – 9.v.1996.
* *Scathophaga stercoraria* (Linnaeus, 1758)
Malaise trap, 31.viii. – 7.ix.1995. Area D on 26.vi.1998 and area A on 13.viii.1997.
(*Trichopalpus fraternus* (Meigen, 1826))

ANTHOMYIIDAE

This family has been neglected by British dipterists and relatively little is known of the immature stages, although they do have a wide range of larval habitats. Some are serious agricultural pests.

ANTHOMYIINAE

Adia cinerella (Fallén, 1825)
Malaise trap, 15.viii. – 5.ix.1995.
Anthomyia confusanea Michelsen in Michelsen & Baez, 1985
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997.
Anthomyia imbrida Rondani, 1866
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997. A male in area B on 26.vi.1998.
Anthomyia liturata (Robineau-Desvoidy, 1830)
Malaise trap, 15.viii. – 5.ix.1995. Area A on 26.vi.1998 and areas A and C on 13.viii.1997.
Anthomyia pluvialis (Linnaeus, 1758)
Malaise trap, 15.viii. – 5.ix.1995.
Anthomyia procellaris Rondani, 1866
Malaise trap, up to 30.vi.1995, 20 – 28.vii.1995, 15.viii. – 5.ix.1995.
Botanophila fugax (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997. Areas A, B and C on 13.viii.1997.
Delia criniventris (Zetterstedt, 1860)
Malaise trap, 15.viii. – 5.ix.1995. A male in area C on 13.viii.1997.
(*Delia florilega* (Zetterstedt, 1845))
Recorded in the 1961 – 1963 survey as *Delia trichodactyla*
Delia platura (Meigen, 1826)
Malaise trap, 15.viii. – 5.ix.1995. Areas A and B on 26.vi.1998.
Eustalomyia festiva (Zetterstedt, 1845)
Malaise trap, 27.vii. – 3.viii.1995.
Eustalomyia hilaris (Fallen, 1823)
Malaise trap, 20 – 28.vii.1995, 17 – 24.viii.1995, 15.viii. – 5.ix.1995.
Eustalomyia histrio (Zetterstedt [1838])
Malaise trap, 15.viii. – 5.ix.1995.
Hydrophoria linogrisea (Meigen 1826)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997.
(*Hylemyia variata* (Fallen, 1823))
Paregle audacula (Harris, [1780])
Recorded in the 1961 – 1963 survey as *Egle radicum*. Area A on 13.viii.1997 and on The Mound on 1.x.1998.
Phorbia fumigata (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.
Subhylemyia longula (Fallén, 1824)
Area B on 13.viii.1997.
Mycophaga testacea (Gimmerthal, 1834)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997. Area A on 1.x.1998 and 31.x.1997 and areas A and B on 19.x.1998.

PEGOMYINAE

Pegomya caesia Stein, 1906
Malaise trap, 24.iv. – 15.v.1997.

Pegomya dulcamarae Wood, 1913
19.x.1998, leaf mines in *Solanum dulcamara.*

Pegomya flavifrons (Walker, 1839)
1.x. and 19.x.1998, north end.

Pegomya geniculata (Bouché, 1834)
Malaise trap, 15.viii. – 5.ix.1995.

Pegomya nigrisquama (Stein, 1888)
Area A on 31.x.1997.

Pegomya rufina (Fallén, 1825)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997. Area A on 31.x.1997 and at the north end of the garden on 19.x.1997.

Pegomya sociella Stein, 1906
Area D on 31.x.1997.

(*Pegomya solennis* (Meigen, 1826))
Recorded in the 1961 – 1963 survey as *Pegomya nigritarsis*

Pegomya winthemi (Meigen 1826)
Malaise trap, 15.viii. – 5.ix.1995.

FANNIIDAE

Seventeen of the sixty known British species are recorded. Apart from *Fannia gotlandica*, which is listed as notable in Falk (1991), all are widespread, common species.

Fannia aequilineata Ringdahl, 1945
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997.

Fannia armata (Meigen, 1826)
Malaise trap, present in twelve collections, April – September.

Fannia atra (Stein, 1895)
Malaise trap, 15.viii. – 5.ix.1995.

Fannia canicularis (Linnaeus, 1761)
Malaise trap, present in six collections, August – November.

Fannia difficilis (Stein, 1895)
Malaise trap, 15.viii. – -5.ix.1995.

Fannia fuscula (Fallén, 1825)
Malaise trap, 20 – 28.vii.1995.

Fannia gotlandica Ringdahl, 1926
Malaise trap, 31.viii. – 7.ix.1995.

Fannia lustrator (Harris, [1780])
Malaise trap, 24.iv. – 15.v.1997.

Fannia pallitibia (Rondani, 1866)
Malaise trap, present in four collections, August – November. Areas A and D on 13.viii.1997 and in area A on 31.x.1997, 1.x.1998 and 19.x.1998.

Fannia parva (Stein, 1895)
Malaise trap, 7-22.ix.1995.

Fannia pauli Pont in Rozkošný, Gregor & Pont, 1997
Malaise trap, 15.v. – 19.vi.1997.

Fannia polychaeta (Stein, 1895)
Malaise trap, present in seven collections, May, July – September. Area D on 26.vi.1998.

Fannia postica (Stein, 1895)
Malaise trap, 7 – 22.ix.1995, 24.iv. – 15.v.1997.

Fannia serena (Fallén, 1825)
Malaise trap, 7 – 22.ix.1995.

Fannia similis (Stein, 1895)
Malaise trap, 7 – 22.ix.1995.

Fannia sociella (Zetterstedt, 1845)
Malaise trap, up to 30.vi.1995, 24.iv. – 15.v.1997.

Piezura graminicola (Zetterstedt, 1846)
Malaise trap, 7 – 20.v.1995, 10 – 17.viii.1995, 15.viii. – 5.ix.1995, 15.v. – 19.vi.1997. Area D on 1.x.1998.

MUSCIDAE

Muscids are strong fliers and often form a large contingent of Malaise trap captures; very few can be identified in the field.

Most of the Coenosiinae species listed are common or very common, though *Pseudocoenosia solitaria* is less frequent. There are no notable records amongst the Muscinae. In the Mydaeinae, *Mydaea ancilla* is the most notable, but it is not a rarity. The most interesting records in this family are in the Phaoniinae; *Helina abdominalis* is a scarce species listed as notable in (Falk 1991), *H. maculipennis* is of localised occurrence whilst *H. obscurata, H. pertusa* and *H. tetrastigma* are somewhat uncommon. Amongst the *Phaonia* species, *P. fusca* is rare, afforded Red Data Book category 3 status in (Falk 1991). Most records are from estuarine sites in south-east England (Assis Fonseca 1968).

COENOSIINAE

Coenosia agromyzina (Fallén, 1825)
Malaise trap, 15.viii. – 5.ix.1995.

Coenosia albicornis Meigen, 1826
Malaise trap, up to 30.vi.1995. Area D on 13.viii.1997.

Coenosia infantula Rondani, 1866
Males in areas A and D on 13.viii.1997.

Coenosia mollicula (Fallén, 1825)
Malaise trap, 7 – 20.v.1995, up to 7.vii.1995, 20 – 28.vii.1995, 15.viii. – 5.ix.1995. Area D on 26.vi.1998.

Coenosia testacea (Robineau-Desvoidy. 1830)
Malaise trap, present in eleven collections, April – September. Area A (on ash of old bonfire site), and area D on 26.vi.1998, area C on 13.viii.1997, area A (males) on 31.x.1997 and 19.x.1998, areas A and B on 1.x.1998.

Coenosia tigrina (Fabricius, 1775)
Malaise trap, present in six collections June – September. Area A on 26.vi.1998 and 19.x.1998, area C on 13.viii.1997 and area B on 1.x.1998.

Limnophora triangula (Fallén, 1825)
Area B on 26.vi.1998.

Pseudocoenosia solitaria (Zetterstedt, [1838])
Malaise trap, 15.viii. – 5.ix.1995.

MUSCINAE

Azelia zetterstedtii Rondani, 1866
Area A on 13.viii.1997.

Hydrotaea irritans (Fallén, 1823)
Malaise trap, 7 – 20.v.1995.

Morellia hortorum (Fallén, 1817)
Area D on 13.viii.1997.

Muscina prolapsa (Harris, [1780])
Malaise trap, April – September.

(*Muscina stabulans* (Fallén, 1817))

Neomyia cornicina (Fabricius, 1781)
Malaise trap, 20 – 28.vii.1995, 25.iv. – 9.v.1996.

(*Polietes lardarius* (Fabricius, 1781))

MYDAEINAE

Hebecnema fumosa (Meigen, 1826)
Area D on 1.x.1998.

Hebecnema nigra (Robineau-Desvoidy, 1830)
Malaise trap, 15.viii. – 5.ix.1995. Area B on 1.x.1998.

Hebecnema vespertina (Fallén, 1823)
Malaise trap, 7 – 22.ix.1995.

Mydaea ancilla (Meigen, 1826)
Malaise trap, 20 – 28.vii.1995.

Mydaea humeralis Robineau-Desvoidy, 1830.
Malaise trap, 7 – 22.ix.1995.

Myospila meditabunda (Fabricius, 1781)
Malaise trap, 20 – 28.vii.1995, 15.viii. – 5.ix.1995, 31.viii. – 7.ix.1995, 7 – 22.ix.1995.

PHAONIINAE

Helina abdominalis (Zetterstedt, 1846)
Malaise trap, 10 – 17.viii.1995, 15.viii. – 5.ix.1995.

Helina depuncta (Fallén, 1825)
Malaise trap, 7 – 20.v.1995, 20 – 28.vii.1995, 7 – 22.ix.1995. Area A on 13.viii.1997 and 31.x.1997.

Helina evecta (Harris, [1780])
Malaise trap, present in eight collections, May – September.

Helina lasiopthalma (Macquart, 1835)
Malaise trap, present in eight collections, April – November. Area A on 26.vi.1998 and area B on 19.x.1998.

Helina impuncta (Fallén, 1825)
Malaise trap, present in six collections, April, May, July – November. Area D on 26.vi.1998 and areas B and D on 1.x.1998.

Helina maculipennis (Zetterstedt, 1845)
Malaise trap, 24.iv. – 15.v.1997.

Helina obscurata (Meigen, 1826)
5.vii.1996, Silver Garden.

Helina pertusa (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.

Helina reversio (Harris, [1780])
Malaise trap, present in twelve collections, April – September. Silver Garden, 5.vii.1996 and area A on 19.x.1998.

Helina tetrastigma (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.

Phaonia angelicae (Scopoli, 1763)
Malaise trap, 7 – 22.ix.1995.

Phaonia errans (Meigen, 1826)
Malaise trap, 7 – 22.ix.1995, 25.iv. – 9.v.1996. Area A on 1.x.1998.

Phaonia fusca (Meade, 1897)
Malaise trap, 24.iv. – 15.v.1997.

Phaonia fuscata (Fallén, 1825)
Malaise trap, 31.viii. – 7.ix.1995, 7 – 22.ix.1995. Area B on 13.viii.1997 and areas B and D on 26.vi.1998.

Phaonia gobertii (Mik, 1881)
Malaise trap, 24.iv. – 15.v.1997.

Phaonia halterata (Stein, 1893)
Malaise trap, 15.viii. – 5.ix.1995.

Phaonia mediterranea Hennig 1963.
Malaise trap, 21.x. – 28.xi.1996, 15.v. – 19.vi.1997.

Phaonia perdita (Meigen, 1826)
Malaise trap, 10 – 17.viii.1995, 17 – 24.viii.1995, 25.iv. – 9.v.1996, 7 – 22.ix.1995.

Phaonia rufipalpis (Macquart, 1835)
Area A on 1.x.1998.

Phaonia rufiventris (Scopoli, 1763)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997. Area B on 19.x.1998.

Phaonia serva (Meigen, 1826)
Malaise trap, 24.iv. – 15.v.1997.

Phaonia subventa (Harris, [1780])
Malaise trap, 24.iv. – 15.v.1997. Area A on 13.viii.1997.

Phaonia trimaculata (Bouché, 1834)
Area B on 1.x.1998.

Phaonia tuguriorum (Scopoli, 1763)
Malaise trap, present in five collections, July – September. 31.x.1997 A, 26.vi.1998 A.

Phaonia valida (Harris, [1780])
Malaise trap, 3 – 10.viii.1995, 15.viii. – 5.ix.1995, 31.viii. – 7.ix.1995, 7 – 22.ix.1995.

CALLIPHORIDAE

All those recorded are common species, apart from *Bellardia bayeri*, which was only recently added to the British list, (Rotheray 1998), though even that may prove to be widespread now that it is recognised as a British species.

CALLIPHORINAE

Bellardia bayeri (Jacentkowský, 1837)
Malaise trap, up to 30.vi.1995, 27.vii-3.viii.1995, 25.iv. – 9.v.1996. Area A on 1.x.1998 A.

Bellardia vulgaris (Robineau-Desvoidy, 1830)
Malaise trap, 17 – 24.viii.1995, 15.viii. – 5.ix.1995, 31.viii. – 7.ix.1995, 7 – 22.ix.1995.

Calliphora vicina Robineau-Desvoidy, 1830
Malaise trap, present in eight collections, April, May, August – November. Area A on 19.x.1998.

(Calliphora vomitoria (Linnaeus, 1758))

LUCILIINAE

Lucilia ampullacea Villeneuve, 1822
Malaise trap, 15.viii – 5.ix.1995.

Lucilia caesar (Linnaeus, 1758)
Malaise trap,, present in five collections, April, May, August – September.

Lucilia illustris (Meigen, 1826)
Malaise trap, 15.viii. – 5.ix.1995, 7 – 22.ix.1995, 24.iv. – 15.v.1997.

* *Lucilia sericata* (Meigen, 1826)
Malaise trap, present in seven collections, April, May July- September. Area D on 26.vi.1998.

MELANOMYINAE

Melanomya nana (Meigen, 1826)
Malaise trap, 20 – 28.vii.1995, 17 – 24.viii.1995.

POLLENIINAE

Pollenia angustigena Wainwright, 1940
Malaise trap, 20 – 28.vii.1995, 7 – 22.ix.1995. Area C on 13.viii.1997.

Pollenia pediculata Macquart, 1834
Malaise trap, 15.viii. – 5.ix.1995, 15.v. – 19.vi.1997.

Pollenia rudis (Fabricius, 1794)
Malaise trap, 3 – 10.viii.1995, 15.viii. – 5.ix.1995, 7 – 22.ix.1995, 21.x. – 28.xi.1996. Silver Garden on 5.vii.1996.

RHINOPHORIDAE

A small family all of whose members are parasitic on woodlice.

Paykullia maculata (Fallén, 1815)
Malaise trap, 20 – 28.vii.1995.

Phyto discrepans Pandellé, 1896
Malaise trap, 17 – 24.viii.1995, 3 – 10.viii.1995, 17 – 24.viii.1995, 7 – 22.ix.1995.

Rhinophora lepida (Meigen, 1824)
Malaise trap, present in eight collections, May, July – September. Areas A and D on 26.vi.1998.

SARCOPHAGIDAE

Sarcophaga africa is the least common in a group of otherwise common species. The *Sarcophaga* species are larviparous, the larvae having a wide range of habitats ranging from dung and carrion or other decaying organic matter to parasitism of other insects and molluscs.

PARAMACRONYCHIINAE

Brachycoma devia (Fallén, 1820)
Malaise trap, present in seven collections April – September.

SARCOPHAGINAE

Sarcophaga africa (Wiedemann, 1824)
Malaise trap, 15.viii. – 5.ix.1995, 24.iv. – 15.v.1997.

Sarcophaga carnaria (Linnaeus, 1758)
Malaise trap, present in seven, April – September.

Sarcophaga melanura Meigen, 1826
Malaise trap, 17 – 24.viii.1995, 7 – 22.ix.1995.

Sarcophaga incisilobata Pandellé, 1896
Malaise trap, present in eleven collections, April, May, July – September.

Sarcophaga nigriventris Meigen, 1826
Malaise trap, present in five collections, May, August, September. Area A on 13.viii.1997.

Sarcophaga subvicina Rohdendorf, 1937
Malaise trap, present in nine collections, April, May, July – September.

Sarcophaga vagans Meigen, 1826
Malaise trap, 15.v. – 19.vi.1997.

Sarcophaga variegata (Scopoli, 1763)
Malaise trap, present in six collections, July – September.

TACHINIDAE

Tachinids are principally parasitoids of other insects, the great majority of the species listed here are widespread, common species. *Cinochira* is somewhat local, and *Thecocarcelia* is only the third British record; see Raper (2001) for a review of the status of the species in Britain.

DEXIINAE

Eriothrix rufomaculata (De Geer, 1776)
Malaise trap, present in six collections, July – September. 13.viii.1997 grassland in area E3, herbaceous border.

Ramonda spathulata (Fallén, 1820)
Malaise trap, 25.iv. – 9.v.1996, 24.iv. – 15.v.1997.

Voria ruralis (Fallén, 1810)
Malaise trap, 7 – 22.ix.1995.

EXORISTINAE

Exorista rustica (Fallén, 1810)
Malaise trap, 10 – 17.viii.1995, 17 – 24.viii.1995.

Thecocarcelia acutangulata (Macquart, 1850)
Malaise trap, 10 –17.viii.1995.
Lydella stabulans (Meigen, 1824)
Malaise trap, 27.vii-3.viii.1995. 1.x.1998. A.
Medina collaris (Fallén, 1820)
Malaise trap, up to 30.vi.1995.
Meigenia mutabilis (Fallén, 1810)
26.vi.1998 A.
Ocytata pallipes (Fallén, 1820)
Malaise trap, present in eight collections, June – November. 26.vi.1998 A B D.
Pales pavida (Meigen, 1824)
Malaise trap, 15.viii. – 5.ix.1995, 3 – 10.viii.1995, 7 – 22.ix.1995, 24.iv. – 15.v.1997.
Phryxe nemea (Meigen, 1824)
Malaise trap, 17 – 24.viii.1995, 7 – 22.ix.1995.
Phryxe vulgaris (Fallén, 1810)
Malaise trap, 7-22.ix.1995.

PHASIINAE
Cinochira atra Zetterstedt, 1845
Malaise trap, 15.viii. – 5.ix.1995, 16.v. – 19.vi.1997.
Phasia pusilla Meigen, 1824
Malaise, 20 – 28.viii.1995. Also in the Silver Garden on 5.vii.1996 and in area D on 26.vi.1998.
* *Lydina aenea* (Meigen, 1824)
Area C on 13.viii.1997.

TACHININAE
Macquartia grisea (Fallén, 1810)
Malaise trap, 25.iv. – 9.v.1996, 21.x. – 28.xi.1996, 24.iv. – 15.v.1997.
Macquartia tenebricosa (Meigen, 1824)
Malaise trap, 21.x. – 28.xi.1996.
Peribaea setinervis (Thompson, 1869)
Malaise trap, 20 – 28.vii.1995.
Phytomyptera cingulata (Robineau-Desvoidy, 1830)
Malaise trap, 15.viii. – 5.ix.1995, 7 – 22.ix.1995, 24.iv. – 15.v.1997.
(*Phytomyptera nigrina* (Meigen, 1824))
Recorded in the 1961 – 1963 survey as *P. nitidiventris*.
Solieria pacifica (Meigen 1824)
Silver Garden, on 5.vii.1996,.
Siphona geniculata (De Geer, 1776)
Malaise trap, present in eleven collections, May – November.
Tachina fera (Linnaeus, 1761)
Malaise trap, 25.iv. – 9.v.1996, 24.iv. – 15.v.1997. Area A on 19.x.1998.
Triarthria setipennis (Fallén, 1810)
Malaise trap, present in seven collections, May – September.

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PLATE K. Buckingham Palace Garden, London. Grassland on top of The Mound. This is area D in the Diptera survey. *Photographed © by Mark Lane*

The scuttle flies (Diptera: Phoridae) of Buckingham Palace Garden

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Abstract

Seventy-five species of scuttle fly are recorded from Buckingham Palace garden. *Megaselia marklanei* **sp. n.** is described from a series of males from the Garden plus a further paratype from France. The diversity of the known natural histories of the recorded species is highlighted and an annotated list presented.

Introduction

Scuttle flies (Diptera: Phoridae) are a large family of small flies that originated not later than the lower Cretaceous. Today they are thought to be the most biologically diverse family of insects in the world. Their larvae are exploiters of every conceivable resource, their habits ranging from dung feeders to obligate parasites. While some are catholic in terms of larval habits most are specialised in varying degrees. Adult feeding includes carrion fluids, plant sugars, fungus spores, cleptoparasites of social insects, preying on small insects, and sucking blood from living insects.

This paper reports on the scuttle flies obtained in a Malaise trap operated on the Mound (just north of the Royal Mews) in Buckingham Palace Garden during 1995. An introduction to the survey of the natural history of this garden has been provided (Plant 1999). The geology, history and habitats are briefly reviewed by McClintock et al. (1999). An earlier survey of the Diptera of the Garden only recorded a single species of Phoridae, *Phora atra* (= *P. aterrrima*) (Richards1964). This species was found to be common in 1995 (see below). The lack of other records by Richards undoubtedly reflects the lack of reliable keys that could be used by a non-specialist in the 1960s. Thus the commonest species in the trap employed in 1995 was *Metopina pileata*, a species only added to the British list when the genus was revised (Disney 1979).

The study of this family has been impeded by formidable taxonomic problems. In particular the modern phorid fauna is dominated by the huge, and taxonomically complex, genus *Megaselia* Rondani. Thus the British phorid fauna exceeds 300 species, with more than 200 belonging to *Megaselia*. The difficulties of species recognition were compounded by the early workers because of their reliance on micro-pinned specimens. A switch to specimens preserved in ethanol for subsequent mounting on slides (Disney 1979) paved the way for new keys to the British species (Disney 1983, 1989). These keys have served two purposes. They have allowed the more confident identification of most specimens as well as serving to indicate when a specimen belongs to a species not previously recorded from Britain. The result is that the British list is continually being augmented (e.g. Disney 1999, Buck and Disney 2001). The present survey continues this trend by describing a further new species below.

A list of the species of a family of insects recorded at a particular site tells us little. Such a list needs to be compared with a regional list and with other sites. Furthermore, by detailing the known natural histories of the recorded species one can open a window on the complex patterns of interrelationships that comprise the ecosystems of the site in question. This is particularly worthwhile with the Phoridae because of the biological diversity of these small flies. I have, therefore, not only provided an annotated list of the species recorded from Buckingham Palace Garden but have also attempted some preliminary comments on the wider significance of this list.

TABLE 1. Scuttle flies which have been reared from decaying organic matter.

Species	**Dung**					**Carrion**				**Refuse in**	
	Insect	Bird	Bat	Rodent	Dog	Snail	Arthropod	Vertebrate		Bumble bee	Wasp nests
								Buried	Exposed		
Conicera similis	-	+	-	-	-	-	-	+	-	-	+
Diplonevra funebris	-	-	-	-	-	+	-	-	-	-	+
Dohrniphora cornuta	-	-	-	-	-	+	+	-	-	-	-
Gymnoptera vitripennis	-	-	-	-	-	-	-	-	-	-	+
Megaselia brevicostalis	-	-	-	-	-	+	+	-	-	-	-
M. densior	-	-	-	-	-	+	-	-	+	-	-
M. giraudii	+	-	-	+	+	+	+	-	+	+	+
M. longicostalis	-	-	-	-	-	+	-	-	-	-	-
M. meconicera	-	-	+	-	-	-	-	-	-	-	-
M. nigra	-	-	-	-	-	+	-	-	-	-	-
M. nigriceps	-	-	-	-	-	-	+	-	-	-	-
M. pleuralis	-	+	-	-	-	-	-	-	-	-	-
M. ruficornis	-	-	-	-	-	+	-	-	-	-	-
M. rufipes	+	+	+	-	-	+	+	-	+	-	+
Metopina oligoneura	-	-	-	-	-	-	-	+	-	-	-
Spiniphora bergenstammi	-	-	-	-	-	+	-	-	-	-	-
Triphleba nudipalpis	-	-	-	-	-	-	-	+	-	-	-
Totals (out of 17)	**2**	**3**	**2**	**1**	**1**	**10**	**5**	**3**	**3**	**1**	**5**

Natural history of the recorded species

The seventy-five species recorded in Buckingham Palace Garden are listed below, with comments on their natural history when anything is known. I first summarise the documented range of natural histories of the species recorded.

The larvae of a number of species are primarily or facultatively saprophagous, exploiting a range of decaying organic matter (Table 1). In addition some of these species, such as *Megaselia rufipes,* will also breed in man-made situations such as compost heaps. Indeed the larvae of the introduced, warm climate, species *Dohrniphora cornuta* will not tolerate frost, but the species has only become established in Britain by breeding in compost heaps, sewage systems and underground rotting organic material in landfill sites, where their larvae are able to escape from ambient temperatures below freezing.

Even this crude collation suggests there is some measure of niche separation in relation to these patchily distributed resources. Only the data for *Megaselia giraudii* and *M. rufipes* indicate broad-spectrum polyphagous saprophage habits. Of these two species, *M. rufipes* is commonly encountered indoors, frequenting waste bins. It is morphologically distinct and shows greater affinity with some warm-climate species than with other British species of *Megaselia.* It is possible that, like the housefly, this species was introduced to Britain by man in Roman times or earlier. By contrast *Dohrniphora cornuta* was first reported from ship cargoes during the twentieth century and no museum specimens have been found that were collected in England before this. The inclusion of *M. nigra* in this table invites comment, as this is primarily a fungus breeder (Table 2). In prolonged dry spells a number of aestivating snails in the soil are apt to die from desiccation and thereby provide a ready resource at a time when fungus sporophores are apt to be scarce. Conversely in prolonged wet spells sporophores tend to be more frequent at a time when snail activity is favoured and moribund snails are scarce.

TABLE 2. Fungus-breeding Phoridae of the Buckingham Palace Garden.

	Numbers of host fungi				
Species	**Families**	**Genera**	**Species**	**S/F**	**S/G**
Conicera similis	2	2	2	1.0	1.0
Megaselia berndseni	7	10	13	1.9	1.3
M. bovista	2	3	5	2.5	1.7
M. cinereifrons	1	1	1	1.0	1.0
M. flava	4	4	4	1.0	1.0
M. frameata	5	6	6	1.2	1.0
M. giraudii	2	2	2	1.0	1.0
M. hirtiventris	2	3	6	3.0	2.0
M. latior	1	2	2	2.0	1.0
M. nigra	6	7	11	1.8	1.6
M. plurispinulosa	2	2	2	1.0	1.0
M. quadriseta	1	1	1	1.0	1.0
M. rubella	6	7	7	1.2	1.0
M. rufipes	4	4	4	1.0	1.0
M. spinicincta	1	2	2	2.0	1.0
M. sylvatica	1	1	1	1.0	1.0

Sixteen species have larvae that have been recorded in fungus species that have been recorded from the Garden (Henrici 2001). These are summarised in Table 2. This includes two primarily saprophagous species, *Megaselia giraudii* and *M. rufipes*. It is possible that these will only breed in sporophores that have started to decay. Likewise it is not clear as to whether *Conicera similis* is primarily fungivorous or saprophagous. Of the rest it is not clear as to how many are truly fungivorous; as some British species associated with fungi are now known to be parasitoids or predators of the larvae or pupae of Sciaridae (lesser fungus gnats), whose larvae feed on fungus mycelium. *Megaselia nigra*, however, has been intensively studied as it breeds mainly in *Agaricus* species, including the cultivated *A. bisporus* and *A. bitorquis* sold in supermarkets throughout the land. This fly is strictly fungivorous, its larvae feed on the sporophore (the mushroom itself). It and its sibling species *M. hirtiventris* seem to occupy an identical niche, apart from the latter not having been reported from the two cultivated *Agaricus* species — but this negative finding may be due to taxonomic incompetence on the part of economic entomologists. The geographical and ecological co-existence of two sibling species suggests two hypotheses. First the work of Shorrocks (1991) on *Drosophila* has shown that two species are able to exploit the same resource simultaneously providing the resource in question is patchily distributed and the eggs of the two competing species are distributed in an aggregated manner. In these circumstances there may be little evidence of traditional resource partitioning or of competition leading to the local extinction of inferior competitors. I hypothesise, therefore, that *M. hirtiventris* and *M. nigra* will be found to lay their eggs in an aggregated manner. In support of this I note that one nearly always obtains numerous individuals of one of these species when rearing insects from an individual mushroom. This contrasts with some other species that invariably emerge in ones or twos from individual toadstools. The second hypothesis is that the evolution of sibling species occupying the same ecological niche has resulted from classic allopatric speciation and a subsequent overlap of their ranges. The evolution of sibling species occupying different ecological niches could result from sympatric speciation, but ecological divergence is probably a prerequisite for this to occur.

TABLE 3. Predatory and parasitic phorids recorded from Buckingham Palace Garden.

		Phorid habit (f = facultative)		
Species	**Host/Prey**	**Predator**	**Parasitoid**	**Parasite**
Diplonevra nitidula	earthworms	-	-	+
D. pilosella	earthworms	-	-	+
Dohrniphora cornuta	larvae of Psychodidae	+f	-	-
Gymnoptera vitripennis	wasp brood	+f	-	-
Megaselia aequalis	slug eggs	+	-	-
M. angusta	spider eggs	+f	-	-
M. ciliata	slug eggs	+	-	-
M. paludosa	tipulid (cranefly) larvae	-	-	+
Phalacrotophora fasciata	ladybird pupae	-	+	-
Phora holosericea	root aphids	+	-	-
Pseudacteon formicarum	worker ants	-	+	-

Table 3 lists species whose larvae have proven to be predators, parasitoids or parasites, but in some cases they are only facultatively so (e.g. *Dohrniphora cornuta* and *Gymnoptera vitripennis*). These phorids represent at least 14.7 per cent of the list for the Garden; however it requires much more careful and critical investigation to establish the details of their larval biologies. Indeed one encounters much frustration in attempting to rear adults from parasitised hosts due to pupal deaths and other losses. It is postulated that several of the approximately 50 per cent of species in the list whose larval habits are unknown will prove to be specialised predators, parasitoids or even parasites.

With regard to some aspects of the ecology of adult scuttle flies, at least 36 per cent of the species recorded from the Garden have been recorded visiting species of flowering plant that are known to grow in the Garden (McClintock and Wiltshire 1999, McClintock and Lane 1999). Table 4 provides a summary of flower-visiting data.

TABLE 4. Summary of records of phorids visiting flower species that are both recorded from Buckingham Palace Garden.

Plant family	No. plant species	No. phorid genera	No. phorid species
Araceae	1	1	2
Araliaceae	1	2	3
Caryophyllaceae	1	1	1
Asteraceae	7	3	8
Convolvulaceae	2	1	1
Cornaceae	1	1	1
Euphorbiaceae	1	1	1
Magnoliaceae	1	1	1
Oxalidaceae	1	1	1
Parnassiaceae	1	2	4
Ranunculaceae	4	3	5
Rosaceae	4	5	13
Salicaceae	2	3	5
Saxifragaceae	1	1	2
Apiaceae	5	6	16
Totals	**33**	**6**	**27**

It is immediately apparent that flowers with easy access to the nectar are being favoured. Table 5 summarises the data for individual phorid species. For many the number of records are few and far between. Most records are for about a dozen fly species. In the case of *Diplonevra funebris* all the records are for males only. Interestingly the proboscis of its male is markedly more slender than that of the female.

With more than half the recorded species never having been reported visiting flowers, one needs to consider other sources of sugars for fuelling flight. Phoridae originated in the Cretaceous, before the evolution of today's families of flowering plants and before the ready availability of nectar-laden flowers. The evidence indicates that the primitive source of plant-sugars, required by flies as the fuel for flight, is the honeydew of homopteran bugs, which evolved long before the flowering plant radiation in the Tertiary. The hypothesis that the primal sugar-source of phorids is honeydew has been proposed (Disney 1994). Among species recorded from the Garden, I have noted *Megaselia angusta, M. pleuralis, Phora atra* and *Triphleba distinguenda* feeding on honeydew. However much more systematic study of this habit is required. *Diplonevra nitidula* has been observed feeding from a leaf of a runner bean by piercing it at the junction of two small veins. Whether such direct ingestion of plant sap is practiced widely by phorids is not known.

TABLE 5. Flower-visiting Phoridae of Buckingham Palace Garden.

Phorid species	**Flower Families**	**Genera**	**Species**
Conicera dauci	2	3	3
C. similis	1	1	1
Diplonevra funebris	4	8	8
D. nitidula	4	5	5
Megaselia aequalis	1	1	1
M. angusta	8	9	10
M. berndseni	1	1	1
M. brevicostalis	5	10	12
M. ciliata	3	4	4
M. clemonsi	1	1	1
M. giraudii	2	2	2
M. latior	1	1	1
M. longicostalis	2	2	2
M. manicata	1	1	1
M. minor	1	1	1
M. pectoralis	1	1	1
M. pleuralis	2	2	2
M. plurispinulosa	1	1	1
M. propinqua	1	1	1
M. rufipes	2	2	2
M. superciliata	2	2	2
Metopina oligoneura	4	8	8
M. pileata	1	1	1
M. ulrichi	1	1	1
Phora atra	3	4	4
Triphleba distinguenda	2	2	2
T. nudipalpis	2	2	2
Totals	**13**	**28**	**33**

Another feature of flower visiting by phorids is its unpredictability. One can visit a patch of hogweed flowers one day and collect numerous phorids. Two days later none are to be had. I suspect that when honeydew is plentiful on leaf surfaces there is a reduced incentive to visit flowers. When the leaf surfaces have been flushed clean by rain, then the flies may have to resort to flower visiting. Again this hypothesis needs testing by carefully planned field investigations.

While all phorids probably require sugar-rich meals to fuel flight, most females will also require a protein-rich meal to mature their eggs. The sources of these protein-rich meals merit more investigation. Furthermore, this difference in male and female diets is reflected in the prevalence of sexual dimorphism in the proboscis. Some females feed on fungus spores, some on yeasts, and others on carrion fluids. Typically, when they have fresh carrion fluids in the gut the eggs in the ovaries are at most only half developed. The partially consumed corpses of the prey of predatory flies, such as Empididae and Scathophagidae, are common on leaves of herbs where these flies have been hunting. These abandoned corpses then become a source of protein for some phorids. For example, I have observed a *Megaselia pleuralis* female feeding from a cranefly corpse on a leaf of dog's mercury *Mercurialis perennis*. Other phorids feed on blood from living insects.

Discussion

The question can be asked as to how rich is the scuttle fly fauna of Buckingham Palace Garden. Any answer can only be provisional in our current state of knowledge. Achieving a comprehensive inventory survey of the Diptera of a particular site is notoriously difficult (Disney 1986). Collecting in the Garden has been limited both in terms of the time of year and of the collecting method employed. Thus there are phorid species that are characteristic of the winter months (e.g. *Triphleba autumnalis*) and species that are unlikely to be caught in a Malaise trap (see Disney et al. 1982). Secondly, our knowledge of the phorid faunas of other comparable sites is sketchy in the extreme.

Table 6 compares the list for the garden with that for the British Isles, the latter being updated from the most recent checklist of British Diptera (Chandler 1998.)

TABLE 6. Summary of the phorid fauna of Buckingham Palace Garden.

	Number of species		
Genus	**British list**	**BPG list**	**%**
Anevrina	4	1	25.0
Conicera	6	2	33.3
Diplonevra	7	3	42.9
Dohrniphora	1	1	100.0
Gymnoptera	2	1	50.0
Megaselia	227	56	24.7
Metopina	8	4	50.0
Phalacrotophora	2	1	50.0
Phora	13	2	15.4
Pseudacteon	3	1	33.3
Spiniphora	4	1	25.0
Triphleba	23	2	8.7
Total genera	**23**	**12**	**52.2**
Total species	**324**	**75**	**23.1**

The only comparable data are for gardens in Cambridge, mainly my suburban garden plus limited collecting from the University Botanic Garden, as summarised in Table 7. Species recorded in Buckingham Palace Garden but not in Cambridge are indicated by an asterisk (†) in the listing below. In both localities just under a quarter of the species and just over half the genera on the British list have been recorded so far. However, of the combined list (of 104 species) for the two localities only 51 per cent have been recorded in both situations.

TABLE 7. Summary of the phorid fauna of gardens in Cambridge.

	Number of species		
Genus	**British list**	**Cambridge list**	**%**
Anevrina	4	1	25.0
Conicera	6	4	66.7
Diplonevra	7	4	57.1
Gymnophora	4	1	25.0
Gymnoptera	2	1	50.0
Megaselia	227	53	23.3
Metopina	8	5	62.5
Phalacrotophora	2	2	100.0
Phora	13	3	23.1
Pseudacteon	3	1	33.3
Spiniphora	4	2	50.0
Triphleba	23	5	21.7
Total genera	**23**	**12**	**52.2**
Total species	**324**	**82**	**25.3**

The species recorded in Cambridge but not in Buckingham Palace Garden are: *Anevrina urbana, Conicera floricola, C. schnittmanni, Diplonevra glabra, Gymnoptera longicostalis, Megaselia collini, M. dahli, M. diversa, M. flavicans, M. halterata, M. involuta, M. lactipennis, M. longifurca, M. minuta, M. oviaraneae, M. pallidizona, M. simplex, M. spinata, M. subfuscipes, M. subnudipennis, M. tumida, M. verralli, Metopina perpusilla, Phalacrotophora berolinensis, Phora tincta, Spiniphora maculata, Triphleba autumnalis, T. intermedia* and *T. lugubris.*

An annotated list of the scuttle flies (Diptera, Phoridae) recorded in Buckingham Palace Garden

The months of capture in the Malaise trap are given in roman numerals. Except where stated otherwise, the detailed references for the biological information are given in Disney (1994). Included in the list is a species new to science. It is described below and named after the Head Gardener, Mark Lane.

Anevrina thoracica (Meigen)† — viii. Pupae have been reported from the nest of a mole. Females ingest fluids from carrion.

Conicera dauci (Meigen) — v, vii-ix. Adults are known to visit flowers of *Anthriscus sylvestris, Crataegus monogyna* and *Heracleum sphondylium.*

Conicera similis (Haliday) — v, vii-ix. Larvae have been reported from buried carrion and the following species of fungi known from the garden — *Leccinum scabrum* agg. and *Pluteus cervinus*. Adults are known from wasp nests, and also visiting vertebrate carrion and flowers of *Heracleum sphondylium*.

Diplonevra funebris (Meigen) — vii-ix. Larvae are known from dead snails. Adults are known from wasp nests and the males only are known to visit flowers of *Heracleum sphondylium, Hypochoeris radicata, Leontodon autumnalis, Potentilla anserina, Ranunculus acris, Rubus fruticosus* agg., *Sonchus oleraceus* and *Taraxacum* spp.

Diplonevra nitidula (Meigen) — v, vii-ix. Larvae are parasites of the earthworm *Lumbricus terrestris*. Adults are known to visit flowers of *Anthriscus sylvestris, Cornus sanguinea, Heracleum sphondylium, Ranunculus acris* and *Salix cinerea* and have been observed piercing a runner bean leaf and imbibing fluid from it. They also ingest fluids from dead earthworms. In August a number of adults were carrying an adult female of the mite *Macrocheles disneyi* (Fain and Greenwood 1991) attached to the underside of the abdomen. This phoretic mite is specific to this species of scuttle fly and has so far never been collected from any other situation.

Diplonevra pilosella Schmitz — v, vii-ix. Larvae are parasites of earthworms.

Dohrniphora cornuta (Bigot)† — viii. Larvae are known from dead snails, dead insects, decaying plants, decaying organic matter in landfill sites, and trickling filter sewage systems. In the last situation they may become facultative predators on moth fly larvae (Psychodidae) if the competition for the carpet of organic material and microorganisms is too severe. This introduced tropical species will not tolerate frost, hence its preference for situations such as those where decay generates heat. Females ingest fluids from carrion, including dead insects.

Gymnoptera vitripennis (Meigen) — viii-ix. Adults are found in wasp nests and the larvae are scavengers of debris in the nest as well as being facultative predators of the wasp larvae.

Megaselia aculeata (Schmitz) — v, viii.

Megaselia aequalis (Wood) — v, viii. Larvae are predators of slug eggs (*Deroceras* spp.). Adults are known to visit flowers of *Crataegus monogyna*.

Megaselia albicaudata (Wood) — v, ix.

Megaselia altifrons (Wood)† — viii.

Megaselia angusta (Wood) — v, viii-ix. Larvae have been reported from spider egg sacs, but possibly only as a secondary invader of already parasitised egg sacs (Disney 1999). Adults are known to visit flowers of *Arum maculatum, Caltha palustris, Crataegus monogyna, Hedera helix, Heracleum sphondylium, Ranunculus ficaria, Salix caprea, S. cinerea, Stellaria media* and *Taraxacum* spp. Fungus spores and yeasts have been recorded in the crops of females and also a reddish pigment, which is almost certainly the eye pigment of insect prey or carrion. Similar pigment has been reported in the crops, midguts and hindguts of female *Megaselia* species killed soon after preying on fig wasps in South Africa. These flies pierce the head, thorax and abdomen of their prey in order to imbibe the fluidised contents.

Megaselia basispinata (Lundbeck) — v, vii-ix.

Megaselia berndseni (Schmitz) — v, viii. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus campestris, Agrocybe modesta, A. praecox, A. pediades, Boletus edulis, B. piperatus, Calocybe gambosa, Collybia dryophila, Coprinus micaceus, Leccinum scabrum* agg., *Psathyrella candolleana, Russula nigricans* and *Xerocomus chrysenteron*. Adults are known to visit flowers of *Conium maculatum*.

Megaselia bovista (Gimmerthal)† — viii. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus augustus, A. bisporus, A. campestris, Calvatia excipuliformis* and *Langermannia gigantea*.

Megaselia brevicostalis (Wood) — v, vii-ix. Larvae are known from dead snails and dead insects. Adults are known to visit flowers of *Caltha palustris, Crataegus monogyna, Heracleum sphondylium, Hypochoeris radicata, Leontodon autumnalis, Magnolia* sp., *Potentilla anserina, Ranunculus acris, R. bulbosus, R. ficaria, Taraxacum* spp. and *Tussilago farfara,* and fungus spores have been recorded in the crops of females.

Megaselia ciliata (Zetterstedt) — v, vii-ix. Larvae are predators of slug eggs (*Arion* and *Deroceras* spp.). Adults are known to visit flowers of *Crataegus monogyna, Heracleum sphondylium, Pastinaca sativa* and *Salix caprea.*

Megaselia cinereifrons (Strobl)† — viii-ix. Larvae have been reported breeding in the following fungus recorded from the Garden — *Byssomerulius corium.*

Megaselia clemonsi Disney — ix. Adults are known to visit flowers of *Crataegus monogyna.*

Megaselia consetigera (Schmitz) — vii.

Megaselia densior Schmitz — v, vii-ix. Larvae are known from dead snails and small vertebrate carrion (Buck and Disney 2001).

Megaselia devia Schmitz — v, viii, ix.

Megaselia drakei Disney — v, viii.

Megaselia emarginata (Wood)† — v, vii-ix.

Megaselia errata (Wood)† — v.

Megaselia fesliensis Disney† — vii. This species was previously known only from the holotype from Inverness.

Megaselia flava (Fallén) — v. Larvae have been reported breeding in the following fungi recorded from the Garden — *Armillaria mellea, Leccinum scabrum* agg., *Peziza vesiculosa* and *Pluteus cervinus.*

Megaselia frameata Schmitz — v. Larvae have been reported breeding in the following fungi recorded from the Garden — *Bjerkandera fumosa, Coniophora puteana, Meripilus giganteus, Pleurotus cornucopiae, Polyporus squamosus* and *Thelephora terrestris.*

Megaselia giraudii (Egger) — v, vii-ix. Larvae are polyphagous saprophages, exploiting resources such as invertebrate frass, rodent and dog dung, dead snails, dead insects, refuse in bee and wasp nests and decaying plants. They have also been reported breeding in the following fungi recorded from the Garden — *Coprinus micaceus* and *Pleurotus cornucopiae.* Adults have been reported visiting cat dung and also flowers of *Crataegus monogyna* and *Heracleum sphondylium.*

Megaselia gregaria (Wood)† — ix.

Megaselia hendersoni Disney† — ix.

Megaselia hirtiventris (Wood)† — vii, ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus augustus, A. campestris, A. silvaticus, A. silvicola, Macrolepiota rhacodes* and *Psathyrella candolleana.*

Megaselia ignobilis (Schmitz) — ix.

Megaselia infraposita (Wood)† — v.

Megaselia latior Schmitz — ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Coprinus micaceus* and *Psathyrella candolleana.* Adults are known to visit flowers of *Crataegus monogyna.*

Megaselia longicostalis (Wood) — v, vii-ix. Larvae are known from dead snails. Adults are known to visit flowers of *Cirsium arvense* and *Crataegus monogyna.* Fungus spores have been recorded in the crops of females and also fluids from carrion.

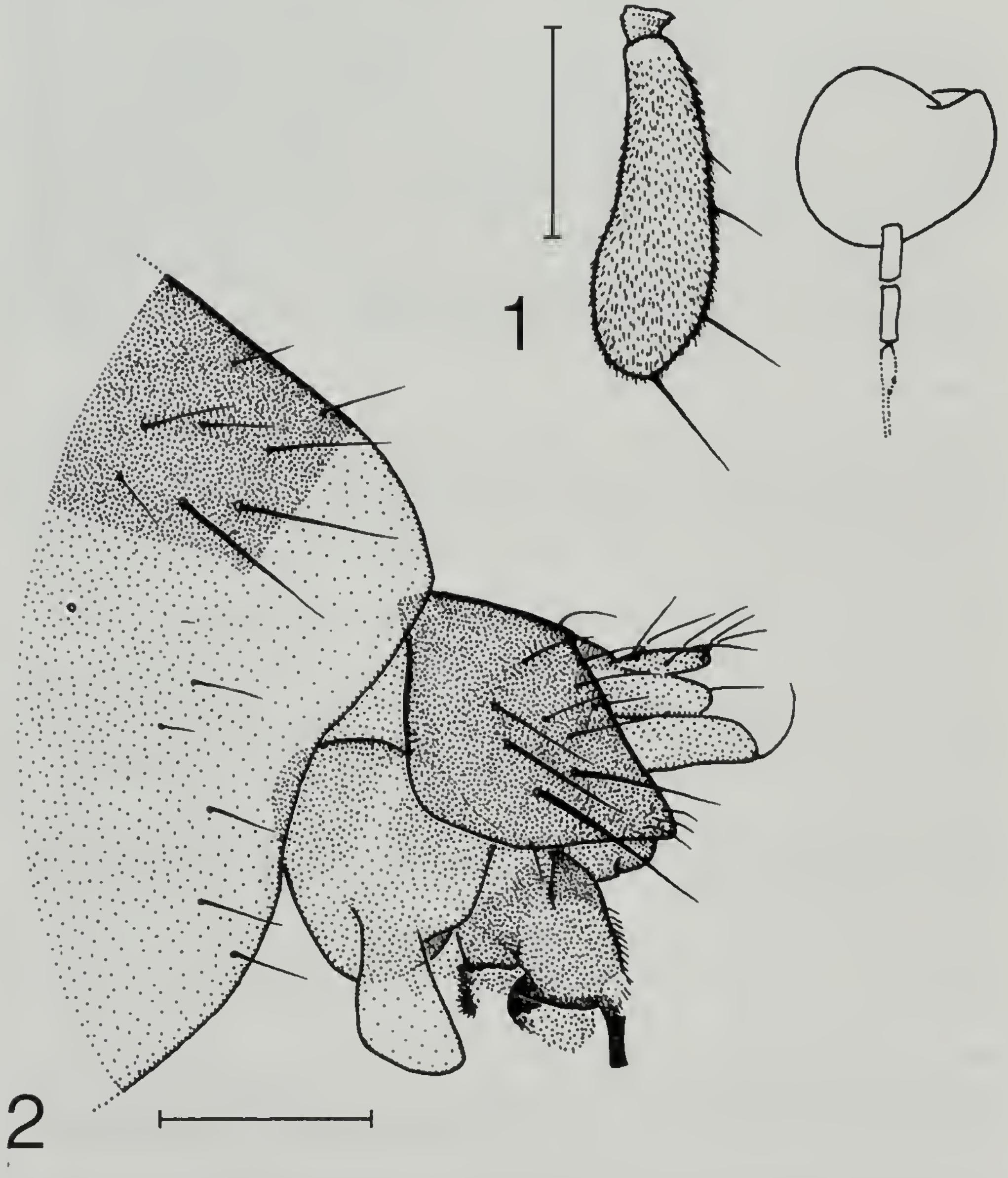
Megaselia manicata (Wood) — viii, ix. Adults are known to visit flowers of *Heracleum sphondylium.*

***M. marklanei* sp. nov.**† — ix.

In the keys to British species (Disney 1989) the males of this species will run to couplets 166 and 176. The elongated, short-bristled, palps are incompatible with the species of couplet 176, including non-British European species that run to this couplet. *M. marklanei* clearly closely resembles *M. longipalpis* (Wood), with which it has been confused in the past, and the Polish species *M. marckdurskii* Disney (in Disney and

Durska 1998), which also runs out at couplet 166. In order to avoid further confusion, I have remounted two cotype males of *M. longipalpis* on slides. These are labelled 'Stoke Wd 2.8.05 — (BM(NH))(E) 239089' and 'Stoke Wd 11.6.06 — (BM(NH))(E) 239090'. The specimen collected in 1905 has been designated the lectotype. A specimen from France that had been attributed to *M. longipalpis* is now recognised as belonging to the new species. The three species are distinguished below.

Megaselia marekdurskii has a pair of minute, hair-like, hypandrial bristles (0.01 mm long) on the inner face. In *M. longipalpis* there are usually no such bristles or else there is a single minute hair (*c.* 0.005 mm long) on the external face of the left side of the hypandrium. In *M. marekdurskii* the hairs at the rear of abdominal tergite 6 are more bristle-like (and feathered) and the legs are more yellowish brown than those of *M. longipalpis.* The new species shares these differences, but has stronger hypandrial bristles (0.05–0.06 mm long), and the left lobe of the hypandrium is not elongated and strongly tapered as in *M. marekdurskii* or twisted as in *M. longipalpis.*



FIGURES 1–2. *Megaselia marklanei* male. 1, outer face of left palp plus outline of third antennal segment. 2, left face of hypopygium. Scale bars = 0.1 mm.

Male only. Frons brown, broader than long (high), with numerous microsetae, and with 76–112 hairs. Lower supra-antennal bristles shorter, weaker and closer together than upper SAs. Antials almost level with or slightly higher than upper SAs, but clearly closer to anterolaterals than to latter. Bristles of middle row in an irregular transverse line, the pre-ocellars being closer together than either is from a mediolateral, but clearly further apart than upper SAs. Third antennal segment brown, but not dark, devoid of SPS vesicles but with an unusually large cavity to accommodate the conus of segment 2. Palps brown, almost as dark as antennae, and as Figure 1, the apical bristle being longer than in *M. longipalpis.* Labrum about as wide as greatest width of palp and pale yellowish brown. Labella with 30-40 short blunt spinules below each. Thorax brown. Each side of scutum with a humeral, three notopleural, an intra-alar, a postalar and a prescutellar dorsocentral bristle. Scutellum with an anterior pair of small hairs (much smaller than those on scutum) and a posterior pair of bristles. Mesopleuron bare. Abdomen with brown tergites with short sparse hairs. Only the posterolateral hairs of T6 are stronger (Figure 2). Venter greyish brown with hairs below segments 3–6. Hypopygium brown, apart from pale greyish yellow left lobe of hypandrium, and as Figure 2. Anal tube brown but distal portion of proctiger more yellowish. Legs yellowish brown, with the femora being darker and that of the hind leg darkest. Fore tarsal segments with ratios of lengths about 2.4 : 1.1 : 1.1 : 0.9 : 1. Only segments 1–4 with a posterodorsal longitudinal hair palisade. The near-dorsal hair palisade of mid tibia extends almost exactly half its length or slightly over. Hairs below basal half of hind femur not differentiated from adjacent hairs of anterior face, and therefore clearly shorter than anteroventral hairs of distal half. Wing length 1.15–1.31 mm. Costal index 0.39-0.42. Costal ratios 3.35–4.20 : 0.94–1.37 : 1. Costal cilia 0.07–0.09 mm long. Veins brown, the costa being more yellowish. Sc free. No hair at base of vein 3. Two axillary bristles, the outermost being at least as long as longest costal cilia. Membrane lightly tinged brownish grey. Haltere brown. Holotype male, ENGLAND: London, Buckingham Palace Garden, 3.viii–7.ix.1995 (Colin. W. Plant) (deposited in Cambridge University Museum of Zoology). Paratypes, 3 males as holotype; 1 male, FRANCE, south end of Cervenne Mountains, near Le Vigan, 25.vii.1984 (Sir Richard Southwood) (CUMZ).

Megaselia meconicera (Speiser) — viii.

Megaselia minor (Zetterstedt)† — v. Adults are known to visit flowers of *Pastinaca sativa.*

Megaselia nigra (Meigen) — ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus augustus, A. bisporus, A. campestris, A. silvicola, A. xanthoderma, Agrocybe praecox, Macrolepiota rhacodes, Melanoleuca melaleuca, Piptoporus betulinus, Psathyrella candolleana* and *Vascellum pratense.* Fungus spores have been recorded in the crops of females.

Megaselia nigriceps (Loew) — viii, ix. Larvae are known from dead insects,

Megaselia paludosa (Wood) — v. Larvae are parasites of cranefly larvae (*Tipula paludosa*).

Megaselia pectoralis (Wood) — v. Adults are known to visit flowers of *Salix caprea.*

Megaselia pleuralis (Wood) — v, vii-ix. Larvae have been reported in bird dung. Adults are known to visit flowers of *Hedera helix* and *Leontodon autumnalis* and to imbibe fluids from dead insects.

Megaselia plurispinulosa (Zetterstedt) — viii. Larvae have been reported breeding in the following fungi recorded from the Garden — *Boletus edulis* and *Pleurotus cornucopiae.* Adults are known to visit flowers of *Anthriscus sylvestris.*

Megaselia propinqua (Wood) — v, viii. Adults are known to visit flowers of *Crataegus monogyna.*

Megaselia pumila (Meigen) — ix.

Megaselia pusilla (Meigen) — v, vii-ix.

Megaselia quadriseta (Schmitz)† — v, ix. Larvae have been reported breeding in the fungus *Russula foetens,* a sibling species of *R. subfoetens* that is frequently not distinguished from it and which has been recorded from the Garden.

Megaselia rubella (Schmitz)† — vii, ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Agaricus campestris, Amanita muscaria, Boletus edulis, Leccinum scabrum* agg., *Lepista nuda, Morchella elata* and *Neolentinus (= Lentinus) lepideus.*

Megaselia ruficornis (Megen) — vii, ix. Larvae are known from dead snails and dead insects. Fungus spores have been recorded in the crops of females.

Megaselia rufipes (Meigen) — v, vii-ix. Larvae are polyphagous saprophages, exploiting resources such as invertebrate frass, bird and bat dung, dead snails, dead insects, refuse in bee and wasp nests, dead rats, human corpses and decaying plants. They have also been reported breeding in the following fungi recorded from the Garden — *Agaricus campestris, Bolbitius vitellinus, Boletus edulis* and *Psathyrella candolleana*. Adults are known to visit flowers of *Heracleum sphondylium* and *Oxalis acetosella*. Arthropod scales and hairs have been recorded in the crops of females.

Megaselia spinicincta (Wood)† — ix. Larvae have been reported breeding in the following fungi recorded from the Garden — *Coprinus micaceus* and *Pleurotus cornucopiae*.

Megaselia stichata (Lundbeck) — viii, ix.

Megaselia stigmatica (Schmitz) — ix.

Megaselia subcarpalis (Lundbeck)† — viii.

Megaselia subpleuralis (Wood)† — ix.

Megaselia sulphuripes (Meigen)† — v.

Megaselia superciliata (Wood)† — vii. Adults are known to visit flowers of *Arum maculatum* and *Tussilago farfara*.

Megaselia surdifrons (Wood)† — v.

Megaselia sylvatica (Wood) — ix. Larvae have been reported breeding in the following fungus recorded from the Garden — *Pluteus cervinus*.

Megaselia tarsalis (Wood) — viii, ix.

Metopina galeata (Haliday) — v, vii-ix.

Metopina oligoneura (Mik) — ix. Larvae have been reported from buried carrion. Adults are known to visit flowers of *Anthemis cotula, Calystegia sepium, Convolvulus arvensis, Euphorbia helioscopia, Hypochaeris radicata, Leontodon autumnalis, Ranunculus acris* and *Taraxacum* spp.

Metopina pileata Schmitz — v, viii, ix. Adults are known to visit flowers of *Heracleum sphondyleum* and *Taraxacum* spp.

Metopina ulrichi Disney — v, viii, ix. Adults are known to visit flowers of *Heracleum sphondylium*.

Phalacrotophora fasciata (FallÇn) — v, viii. Larvae parasitise pupae of ladybird beetles (Coccinellidae) and adults suck blood from the same.

Phora atra (Meigen) — v, vii-ix. Richards (1964) reported this species in the garden in June and August. Adults are known to visit flowers of *Anthriscus sylvestris, Crataegus monogyna, Prunus laurocerasus* and *Torilis japonica*. Adults have also been reported visiting cat dung.

Phora holosericea Schmitz — v. Larvae prey on root aphids (Aphidiidae and Pemphigidae).

Pseudacteon formicarum (Verrall) — v, viii. Larvae are parasitoids of worker ants, mainly species of *Lasius*.

Spiniphora bergenstammi (Mik) — ix. Larvae are known from dead snails. Adult females feed from vertebrate carrion.

Triphleba distinguenda (Strobl) — v, vii-ix. Adults are known to visit flowers of *Crataegus monogyna* and *Heracleum sphonaylium*.

Triphleba nudipalpis (Becker) — vii-ix. Larvae have been reared from dead mice, dead earthworms and other carrion buried in soil. Adults are known to visit flowers of *Hedera helix* and *Salix caprea*.

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Hoverflies (Diptera: Syrphidae) in Buckingham Palace Garden

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Abstract

Hoverflies (Diptera: Syrphidae) were sampled in Buckingham Palace Garden using a single Malaise trap, operated between 20 April 1995 and 18 August 1997 and through regular field survey during the period 1995 to 1997. Thirty-seven species were recorded. Two further species recorded in an earlier survey bring the overall total for the Garden to thirty-nine. The species are listed and discussed. The hoverfly fauna fully reflects the available habitat types.

Introduction and survey methods used

In an earlier survey of Buckingham Palace Garden, carried out in the period from 1961 to 1963 (Richards 1964), a surprisingly low total of seven species of hoverfly was recorded. With the exception of the drone fly *Eristalis tenax*, all the recorded species were members of the aphidiphagous subfamily Syrphinae. It is unclear how many visits were made to the Garden in the earlier survey, as indeed are the dates of such visits, but it seems likely that the level of recording may have been rather lower than the survey co-ordinators at the time may have wished.

At the planning stage of the present survey, it was determined that it would be necessary to sample insects (in all groups) in each month of the year, for each of the three years, in order to obtain as complete a list as possible of the fauna present. Set against this, however, were several inevitable and necessary restrictions placed upon the timing of visits to the Garden by myself and other members of the survey team. In order to maximise results, therefore, a decision was taken to deploy a Malaise trap. This was operated continuously from 20 April 1995 to 18 August 1997 in an area of rough grassland under the shade of a variety of trees (*antea* Plate E, page 108) on The Mound (*antea* Map on pages 2–3).

In addition to sorting hoverflies from the Malaise trap, a number of visits were made to the Garden on various dates throughout the seasons and hoverflies were observed and usually collected, either by netting them in flight or by use of a sweep-net on vegetation. All areas of the Garden were sampled, apart from the large, open areas of mown lawn. Some searching for larvae was also conducted, though this met with only limited success.

Results

An all time total of 39 species of hoverfly is recorded for the Garden. Of these, two species, *Platycheirus clypeatus* agg. and *Sphaerophoria rueppellii*, are now apparently absent from the Garden, so that the current total is 37 species. Eighteen of the 37 were recorded only in the Malaise trap, indicating a certain advantage held by modern entomologists over those who surveyed the Garden in the early 1960s. One species, *Neoascia podagrica*, was found only by active recording and was absent from the Malaise trap samples. Another species, *Platycheirus rosarum*, was represented only in pitfall trap samples. Seventeen species were represented in captures from both active fieldwork and the Malaise trap. All recorded species are discussed individually in the list below.

An annotated list of hoverflies (Diptera: Syrphidae) recorded in Buckingham Palace Garden

Generic and specific nomenclature in this list follow Chandler (1998). The suprageneric taxonomy of the Syrphidae is far from adequately understood. Chandler (*op. cit.*) arranged species strictly alphabetically for this reason. In the present list, however, the arrangement of species follows that of Stubbs and Falk (1983), since this will be the most familiar to British readers and is therefore the sequence most likely to facilitate understanding of the overall fauna. Species found in the earlier survey, but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey.

SYRPHIDAE

SYRPHINAE

Bacchini

Baccha elongata (Fabricius, 1775)

Recorded in small numbers from April to October, inclusive, though with most examples encountered in June and July. It is associated with ground layer aphids in shaded places (Rotheray 1993) and in Buckingham Palace Garden appears to be confined to the shaded areas under trees growing on The Mound. All records are from the Malaise trap (9♂♂, 19♀♀); searching other potentially suitable areas such as the area around Fire Hole did not yield any additional examples.

Melanostoma mellinum (Linnaeus, 1758)

Apparently scarce, as evidenced by the Malaise trap, which yielded only 19 examples (4♂♂, 15♀♀), between 7.v.1995 and 18.viii.1997, compared with 169 *M. scalare*. Data from the Malaise trap also indicate that adults are on the wing from April to September, but active fieldwork, which also supported the notion that this species is numerically scarce, suggests that there is a definite peak of adult activity in July. The feeding habits of the larvae are uncertain, but it is suspected that they may be general predators in leaf litter (Rotheray 1993). In Buckingham Palace Garden, males and females were recorded in the Malaise trap (rough grassland shaded by deciduous trees), females occasionally in Fire Hole, one female hovering (but not feeding) at ornamental flowers near the Waterfall and one female on the Island at the end of Bridge Number 1 (swept from vegetation).

Melanostoma scalare (Fabricius, 1794)

This is a widespread and numerically common hoverfly in Buckingham Palace Garden. Records from the Malaise trap indicate an adult presence from May to October, but there is a large peak in numbers in the period May to July, with far fewer examples from August to October. Away from the Malaise trap, females were a common sight hovering at a variety of ornamental flowers though, surprisingly, feeding has not been observed. In the Malaise trap, females outnumber males 3:1 (126♀♀, 43♂♂); during active fieldwork far more females were seen than males, but detailed counts were not made.

* *Platycheirus albimanus* (Fabricius, 1781)

This is another widespread and numerically abundant species in the Garden, recorded from March to the end of October both in the Malaise trap (41♂♂, 44♀♀), and through active survey. Other than the lawn areas and The Lake, there can be few areas within the boundary walls that did not produce this ubiquitous species. A female was observed ovipositing on the undersides of leaves of a number of herbaceous plants in the Silver Garden on 5.vii.1996.

(*Platycheirus clypeatus* agg.)

The earlier survey records *Platycheirus clypeatus* during July. In recent years, that taxon has been split into a number of species (Goeldlin de Tiefenau et al. 1990), and since no voucher material has been found it is not possible to say which segregate is in fact referred to. *P. clypeatus* s. str., *P. occultus* and *P. europaeus* are all recorded in the London area. All the segregates seem to be related to a greater or lesser degree to lush vegetation or damp ground and it is presumably the overall dry state of the Garden that is responsible for a complete lack of records of any of these species during the current survey.

Platycheirus scutatus (Meigen, 1822)

This is a common and widespread species of hoverfly in the Garden, on the wing from May to October, but with a clear peak throughout June and, during 1995, a single female in the November Malaise trap sample (28.x.–20.xi.1995). Females outnumber males 2:1 in the Malaise trap (88♀♀, 37♂♂), but this experience is not supported by active fieldwork at the flower borders where more or less equal numbers of each sex were sampled. Since *P. splendidus* Rotheray, a recent 'split' from *P. scutatus*, is not included in Chandler's checklist, it is perhaps worth noting here that this new segregate is not recorded in Buckingham Palace Garden.

Platycheirus rosarum (Fabricius, 1787)
A single female was taken in the pitfall trap in map square E3 (*antea* Map on pages 2-3) during August 1996.

Syrphini

Chrysotoxum bicinctum (Linnaeus, 1758)
Known from the Garden as a single female in the Malaise trap sample for 20–27.vii.1995. This is a somewhat unexpected record in central London, though the species is tolerably common on most ruderal sites alongside the River Thames. The larvae are suspected to be in some way dependant on ants and may perhaps predate ant-tended root aphids (Rotheray 1993), but there appear to be rather few ant nests in the Garden. The possibility exists that this hoverfly was merely passing through the area.

Dasysyrphus albostriatus (Fallén, 1817)
This is typically a woodland edge hoverfly, with arboreal larvae. It is very common on The Mound and in association with the shrubbery areas and trees along the boundary wall at Constitution Hill. The Malaise trap records 7♂♂ and 32 ♀♀ between 7.v.1995 and 18.viii.1997, from April to July, with just two examples (1♂, 1♀) in August 1995. The bulk of records fall into the months of May and June, however.

Dasysyrphus venustus (Meigen, 1822)
This distinctive hoverfly is known in Buckingham Palace Garden as a single female example in the Malaise trap sample for 15.v.–19.vi.1997. Like the preceding species, it is associated with woodland edge and its apparent rarity here is unexpected. Elsewhere in London it is sometimes found hovering beneath blossom-bearing horse-chestnut trees in parks and in street situations, though it is usually seen as single examples.

Epistrophe eligans (Harris, [1780])
Although this is usually a common spring sight in London, rather few examples were found in Buckingham Palace Garden and, interestingly, none at all during 1995. During the subsequent two years it was recorded in the Malaise trap and by active field survey in April and May, but was finished by the start of June. The 35 examples in the Malaise trap included only two males. The larvae feed on aphids on trees, bushes and tall herbs (Rotheray 1993).

* *Episyrphus balteatus* (De Geer, 1776)
This is undoubtedly the most numerically abundant hoverfly in the Garden, with a total of 510 examples in the Malaise trap, comprising 213♂♂ and 297♀♀. However, this species is a known immigrant, and numerical peaks during August in 1996 and 1997 are likely to be partly explained by this behaviour. In particular, there were larger than usual numbers in the middle two weeks of August 1997, coinciding with the only Garden record of *Scaeva pyrastri*, and data from the Malaise traps suggest that both males and females were involved in equal proportions (86♂♂, 82♀♀). Most records fall from April to October, though there was a female in February 1997 and two females in March of the same year.

Eupeodes corollae (Fabricius, 1794)
During 1995, low numbers were present from the start of May until early August, suggesting a low-density resident population. A similar pattern was evident during 1996, though the total number of individuals was far lower (8♀♀) than in 1995 (5♂♂, 22♀♀). In the third survey year, however, there was no sign of this species until the middle two weeks of August, when the appearance of 5♂♂ and 10♀♀ in the Malaise trap coincided with the apparent influx of *Episyrphus balteatus*, mentioned above. It seems likely, perhaps, that temporarily resident populations result from primary immigration and that in the absence of further immigration these do not become permanent.

Eupeodes luniger (Meigen, 1822)
There was an overall total of 248 examples of this species in the Malaise trap, with four times as many females as males (58♂♂, 190♀♀). The fly was also encountered frequently during fieldwork throughout the Garden. Interestingly, there were two peaks in each year, from April until about the end of July and from mid August to September, separated by a gap of about two weeks in early August when there were no records. A sevenfold increase in number in mid June 1997, coinciding with a sudden rise in numbers of *Episyrphus balteatus*, may suggest an influx of immigrants (18♂♂, 56♀♀ in that sample, compared to a more usual level in the order of ten examples). However, there were no *E. luniger* at all in the middle two weeks of August 1997, when there was an influx of *Episyrphus balteatus*, *Eupeodes corollae* and a single *Scaeva pyrastri*.

Meligramma triangulifera (Zetterstedt, 1843)
Falk (1991) listed this hoverfly as Nationally Notable, though the distribution map in Ball and Morris (2000) suggests that it is either rather more widespread than previously thought or else it has fared rather better in the past ten years. In London, it is increasingly found in domestic gardens and Buckingham Palace Garden is no exception, with five females in the Malaise trap between 7.v. and 27.vii.1995 and one more in the sample for 15.v. to 19.vi.1997. Morris (1998) showed that the species is widely distributed in Surrey, but with a greater density of records nearer to London than elsewhere in that county, and queried whether this reflected the true situation or some form of recording bias. It seems possible that the former may be the case.

* *Meliscaeva auricollis* (Meigen, 1822)
The earlier survey of Buckingham Palace Garden simply records the presence of the species as 'var. *maculicornis* Zett.' in July with no further comment. In the present survey, the Malaise trap caught the species continuously from 7.v. to 27.vii.1995, from 6.vi. to 15.viii.1996 and from 24.iv. to 18.viii.1997 (a total of 17♂♂ and 19♀♀), but it is not possible to discern discrete generations in any of these years. According to Stubbs and Falk (1983) f. *maculicornis*, in which the yellow tergite spots do not coalesce, is typical of the spring generation and far less frequent in that of the summer, where the spots usually unite to form bands. This statement is not fully supported by evidence from Buckingham Palace Garden; although there were slightly more *maculicornis* than *typica* in the early samples, the two forms were both recorded across the year in more or less equal proportion. Morris (1998), writing about Surrey, also notes that there is a 'much darker spring brood'.

Scaeva pyrastri (Linnaeus, 1758)
There is only a single example of this species, a female, in the sample for mid-August 1997. This is presumed to be an immigrant example.

(*Sphaerophoria rueppellii* (Wiedemann, 1830))
This species is frequent, and numerically common, in almost all ruderal habitats alongside the River Thames in London and eastwards around the coast in Essex and Kent, frequently outnumbering *S. scripta* at some sites. It is also found in good number on ruderal plots away from the Thames, at least in north London. It was recorded in the Garden during May in the earlier survey, but has not shown itself to be present during the 1995–1997 study. The only area of ruderal habitat present in the Garden during the current survey was in the vicinity of the Fire Hole, although this area does not bear any real resemblance to the Thames-side ruderal sites and the fly is, very possibly, genuinely absent.

Sphaerophoria scripta (Linnaeus, 1758)
This common grassland hoverfly is evidently very rare in Buckingham Palace Garden, which is rather surprising for a species that is generally widespread and common, exhibits good dispersal and is tentatively linked to immigration on occasions. It was not listed in the earlier survey. In the present study it was found in the Malaise trap, with two males in the sample for 27.iii.–24.iv.1997 and a female, presumed to be this species, in the sample for 24.iv.–15.v. in the same year, whilst Peter Chandler also noted a specimen during August at a herbaceous border. It is rather surprising that sweep-netting and other active collecting techniques did not reveal this species elsewhere in the Garden.

* *Syrphus ribesii* (Linnaeus, 1758)
This more or less ubiquitous hoverfly species can be encountered in most London parks and in other areas where there are trees or shrubs. Buckingham Palace Garden is no exception and adults are common from May to October inclusive, though with a definite peak of numbers in May and June. The earlier survey recorded adults in July, September and October. The Malaise trap caught a total of 88 examples from 1995 to 1997, of which only 27 were male, a ratio of about one male to three females. Adults were also netted on most visits at various points throughout the Garden and larvae were found on aphid-covered leaves of a sycamore tree during July 1995.

Syrphus torvus Osten Sacken, 1875
Although this species is as equally widespread as *S. ribesii* and *S. vitripennis*, it is seldom numerically abundant. Just three females were recorded in Buckingham Palace Garden, all in the Malaise trap — one in the sample for 7–22.ix.1995 and two in that for 27.iii.–4.iv.1997.

Syrphus vitripennis Meigen, 1822
This species is, like its congener *S. ribesii*, a common London species. In Buckingham Palace Garden it clearly has two generations per year, with records in May and June and

then a clear gap before more are encountered in September and October. This is a near fit to the national situation presented by Ball and Morris (2000), who demonstrate peaks in May/June and August/September, although they do not show any gap between the two date bands. Overall the Malaise trap captured 53 examples, comprising 10♂♂ and 43♀♀.

Xanthogramma pedissequum (Harris, [1776])

This species, like *Chrysotoxum bicinctum*, is believed to have some form of myrmecophilous relationship and in view of the scarcity of *C. bicinctum* in the Garden it is perhaps surprising to record 28 *X. pedissequum* over the three years 1995 to 1997, mostly as singletons in the Malaise trap. This perhaps suggests a low-density resident population. Other examples were netted in flight in the Fire Hole area and, interestingly, no males have been encountered at all in the Garden. All records are from May to August, inclusive, but recorded numbers are too low to discern any generation peaks. Outside the Garden, the species is tolerably common, but always in small number, in ruderal sites about London, though the present records appear to be the first for the central area. What we understand as *Xanthogramma pedissequum* probably represents a complex of three species (Kassebeer, in prep.). However, since formal descriptions and names of the segregates have not yet been published it would be inappropriate to comment in too great a depth here. What can be said, to enable these records to be correctly allocated at some future date, is that the specimens from Buckingham Palace Garden belong to the segregate that possesses only a single yellow thoracic mark anterior to the pleurae.

MILESIINAE

Cheilosiini

Cheilosia pagana (Meigen, 1822)

This is an almost ubiquitous hoverfly at London sites. According to Rotheray (1993) larvae of *C. pagana* are associated with semi-liquid fungal decay of plants and have been found in the decaying roots of *Anthriscus sylvestris*. 'Weeds' such as this might well be pulled up by the gardeners, leaving sections of root in the ground to decay and provide a breeding site. Interestingly, the Malaise trap captured ten females between 7.v. and 27.vii.1995, but none at all in the following two years, although occasional adults were found in the Fire Hole area, at ornamental blooms in the Silver Garden and at The Border. As with *Xanthogramma pedissequum*, no males have been encountered in Buckingham Palace Garden.

Chrysogastrini

Neoascia podagrica (Fabricius, 1775)

The fact that the larvae of this species are associated with decaying vegetation, manure and the like, including around pond margins, helps explain why there were no adults at all in the Malaise trap on The Mound, whilst they were seen occasionally in the area around the Recycling Centre (a giant compost heap). Records, which are almost exclusively of females, are available from May to September though the species is not especially numerous here. The disproportionate number of females observed by active field survey suggests strongly that they were likely to be breeding in the areas found and indicates that different methods are required, or else different places need to be searched, to locate the males.

Eristalini

Eristalis (Eoseristalis) intricarius (Linnaeus, 1758)

This bumble-bee mimic is recorded in Buckingham Palace Garden as a single female in the Malaise trap sample for 30.vi.–7.vii.1995.

* *Eristalis (Eristalis) tenax* (Linnaeus, 1758)

The well-known 'drone fly' is, perhaps surprisingly, recorded very sparingly in the current survey. The Malaise trap captured only a single female, in the sample from 15.v.–19.vi.1997, whilst Peter Chandler noted it on two occasions at a herbaceous border during August. It is listed for the earlier survey for October, but no other information is given. The 'rat-tailed maggot' larvae feed in wet, decaying organic material, including liquid manure, eutrophic ponds and similar places.

Myathropa florea (Linnaeus, 1758)

The rather small number of records from the Malaise trap, representing one male and eleven females for the three-year period, suggests that the population of this species is relatively low in the Garden. The records are spread from May to June and August to September. Larvae of *M. florea* are seemingly able to adapt to a wider variety of eutrophic microhabitats than *Eristalis* or *Helophilus*, and are often found in ground level rot-holes at tree bases, in ditches or even in broken sewers and drains.

Merodontini

Eumerus ornatus Meigen, 1822

A single female of this species was present in the Malaise trap sample taken from 20.v - 23.vii.1995. It is, typically, a fly of broadleaved woodland in south central Britain and its presence in Buckingham Palace Garden was most unexpected. However, like other members of the genus it flies very close to the ground and is easily missed by the entomologist and would have been able to fly underneath the Garden Malaise trap. It is listed as Nationally Notable by Falk (1991), but may have increased in range in recent years.

Eumerus strigatus (Fallén, 1817)

The Malaise trap captured one male and five females during August 1995, but none in subsequent years (perhaps, as with *E. ornatus*, because of their habit of flying so low that they missed the trap). None of this species was found by active field survey.

Eumerus funeralis Meigen, 1822 (=*tuberculatus* Rondani, 1857)

This species is widely known to gardeners as the Lesser Bulb Fly, though the larvae are usually less of a pest than those of *Merodon equestris*, since they tend to occupy bulbs that are already damaged and starting to decompose. In keeping with most sites in the London area, *E. tuberculatus* is evidently more numerous in Buckingham Palace Garden than *E. strigatus* (though both are widespread). Thirty individuals, comprising 12♂♂ and 18♀♀, were taken in the Malaise trap and one female was netted in flight on The Mound during July 1996. Peter Chandler also encountered the species in square E3 (*antea* map on pages 3 and 3) and at the margin of The Lake. Records from the Garden span the period from June to September, but the number of individuals is too low to discern population peaks.

Merodon equestris (Fabricius, 1794)

Known to the horticultural trade as the 'Bulb Fly', this species appears to be thriving in Buckingham Palace Garden, with a total of 46 examples (24♂♂, 22♀♀) in the Malaise trap throughout May, June and July in all three years of the survey, plus others netted at flowers during active fieldwork. This hoverfly is a bumble-bee mimic and is noted for its variety of colour forms, many of which have been named. It is presumed that this variation permits the fly to mimic different bee species, though to what end is unclear. In Buckingham Palace Garden, the colour forms represented in the Malaise trap samples are indicated in Table 1.

TABLE 1. Proportions of named colour forms of *Merodon equestris* recorded in the Malaise trap in Buckingham Palace Garden between 7 May 1995 and 18 August 1997.

Colour morph	Number	
	♂♂	♀♀
f. *equestris* Fabricius	20	8
f. *narcissi* Fabricius	4	5
f. *transversalis* Meigen	-	5
f. *validus* Meigen	-	4

There was no seasonality discernible in the four forms, with all distributed randomly across the May to July period. It may be of interest to note that there were no males of f. *transversalis* or of f. *validus*.

Pipizini

Heringia (Neocnemodon) vitripennis (Meigen, 1822)

This species is currently represented by a single female in the Malaise trap sample for 7–20.v.1995. According to Roger Morris (pers. comm.) it is often found by examining Sycamore-tree leaves for resting adults during May. If this is the case, then perhaps a greater amount of field survey in that month would have revealed a stronger presence of this species in the Garden. It may be of interest that I had not encountered this fly until Morris told me how to find it. Since then I have found it on a few occasions in the London area in the manner prescribed. It seems eminently possible, therefore, that it is an under-recorded species in the London area and may well be far more common in Buckingham Palace Garden than the present data suggest.

Volucellini

Volucella inanis (Linnaeus, 1758)

Only a single example of this large and striking hoverfly is recorded in the Garden, a female during August 1997, at a time of raised numbers of *Episyrphus balteatus* and *Eupeodes corollae*, and in the same Malaise trap sample as the only example of *Scaeva pyrastri*. This evidence points to an immigrant example. The species is usually common in the London area; the larvae feed on larvae of social wasps, including *Vespula germanica* and *Vespa crabro*, residing inside the wasps' nest.

Volucella pellucens (Linnaeus, 1758)

As with the previous species, the larvae of *V. pellucens* live inside nests of social wasps, including the hornet, but are scavengers rather than predators. It is a very common insect in the London Area, and is a regular sight at bramble blossom in many areas. The fact that only four examples were noted in Buckingham Palace Garden (two females in the Malaise trap sample for 22.5.–23.vi.1995 and two females in the sample for 27.vi.–11.vii.1996) is rather surprising. Taken with the equally low numbers of the other two members of the genus, and the fact that all three are common London species, the evidence perhaps suggests a shortage of host nests (presumably, most wasp nests in this part of London would be removed before any *Volucella* larvae within could reach maturity).

Volucella zonaria (Poda, 1761)

Prior to about 1940, this was a very rare immigrant to the southern coastline of Britain. Since that period, it has become established at various places along the south coast and especially in the London Area where it is a common resident. Personal experience suggests that there are regular autumn influxes, most often involving only female examples. It is, therefore, rather surprising that it was apparently rare in Buckingham Palace Garden during the survey. A single female only was recorded in the Malaise trap (sample for 7–20.v.1995), and Peter Chandler recorded one at flowers during August. There are no other records. Comments on the shortage of long-term wasp nests given under *V. pellucens*, above, probably apply.

Xylotini

Syritta pipiens (Linnaeus, 1758)

This is a rather frequent hoverfly in the London area and there are few site lists that do not contain it. Interestingly, the Malaise trap caught only a single example — a female in the period 7–20.v.1995. However, field observations indicate that it is a regular and numerous visitor to the various flower beds, especially at the Silver Garden and The Border. Records span the period from May to September, with both males and females captured in more or less equal number.

Xylota segnis (Linnaeus, 1758)

This is another common and widespread species in the London area that is very poorly represented in Buckingham Palace Garden, with only a single example, a male, in the Malaise trap sample for 27.vii.–3.viii.1995 and none seen during active field survey. It is a representative of a generally saproxylic genus, though itself may not be totally dependant upon such microhabitat, having been associated also with silage and decomposing potatoes (Ball and Morris, 2000).

Discussion

That some 61 per cent of the all time total of thirty-eight recorded species are, or are presumed to be, aphidiphagous (all twenty-two Syrphinae plus *Neocnemodon vitripennis*), should not come as a particular surprise in view of the entirely artificial garden habitat under study. Nor indeed should the presence of species whose larvae feed in bulbs (the genera *Eumerus* and *Merodon*). Of greater interest, perhaps, are the species that have not been recorded here.

Wetland species are almost entirely absent, and are represented only by the two species of *Eristalis* (only a single example of each) and by *Helophilus pendulus* (only two examples). These three are rather more generalist than, for example, species within *Anasimyia*, *Chrysogaster* or *Parhelophilus*, and are frequently found as larvae in the detritus that accumulates in garden ponds in the London area. However, whilst lack of suitable habitat offers an easy explanation for the absence of wetland hoverflies, the non-occurrence of the almost ubiquitous *Eristalis arbustorum*, or for that matter *E. pertinax*, is rather more of a mystery.

Lack of appropriate habitat is likely also to be the reason for the absence of members of the large genus *Cheilosia*, which is represented here by a single species — *C. pagana*. According to Rotheray (1993), members of this genus divide into five categories based upon larval feeding styles — mycophagous species, those feeding on the semi-liquid decay of plants, those which tunnel in roots and stems, leaf-mining species and those which feed in the cambium or sap of pine trees. The latter habit is represented in Europe by a single species that does not occur in Britain, whilst the south-east of England is also outside the geographical range of the leaf-mining species. The mycophagous species seem to require good populations of *Boletus* — a microhabitat absent from the Garden. It is presumed that root and stem tunnelling species are unable to survive in the Garden as a consequence of either the absence of natural host plants or the rapid turnover of garden plants that may act as alternative hosts. *Cheilosia pagana*, the only *Cheilosia* present in the Garden, is the only British species that feeds on semi-liquid decay of plants. Many records of this hoverfly are, apparently, associated with stands of *Anthriscus sylvestris* (Alan Stubbs, pers. comm.), although there is no firm evidence as yet to confirm any obligatory relationship.

The near total lack of species associated with dead branches or with decaying stumps is less than surprising in a 'tidy' garden in a city habitat. Species associated with sap runs, such as *Brachyopa insensilis* Collin or *Ferdinandea cuprea* (Scopoli), which are present in the central London area, probably depend to some extent on mechanical damage to trees by humans, so are confined to more public areas, such as Hyde Park. In fact *Xylota segnis* is the only saproxylic hoverfly in the list, and though the larvae do feed on rotting wood, they can also survive in decaying vegetation. It is, in any event, represented here by only a single example.

The genus *Volucella* represents another ecological group. With the exception of *V. inflata* (Fabricius), a saproxylic species which is not expected here, they feed, as larvae, inside the nests of social wasps and/or hornets. All four such species (*V. bombylans*, *V. pellucens*, *V. inanis* and *V. zonaria*) are widespread and very common in London (Plant 1986, 1990). In Buckingham Palace Garden, however, *V. bombylans* is not represented, whilst the other three are present on the basis of single specimens for *V. inanis*, two for *V. zonaria* and only four examples of *V. pellucens*. Presumably human intolerance of wasp nests results in a reduction of suitable breeding sites that survive long enough for *Volucella* to complete its life cycle?

The absence of a few species is less easy to explain. For example, there are no records of *Paragus haemorrhous* Meigen, and no representatives at all of the genera *Pipiza* and *Pipizella*. Both *Pipizella viduata* (Linnaeus) and *Pipizella virens* (Fabricius) are both widespread and locally abundant in most ruderal sites within the London Area and are easily netted from white-flowering Umbelliferae (Apiaceae) and other plants. They might be expected to exist in the Garden at one or two spots although it is of note, perhaps, that they are most frequent at sites along the banks of the River Thames. *Paragus haemorrhous* is harder to find, as it generally flies at only one or two centimetres above the ground over bare soil in areas of sparse vegetation (not an abundant habitat in the Garden), and when it rises higher it is usually to visit the flowers of brambles, where use of a net can prove expensive! It is a widespread species on sparsely vegetated ruderal sites throughout London and is far more common than most people seem to realise.

The future

Whilst it is surely likely that one or two further species of hoverfly remain to be discovered in Buckingham Palace Garden, the present list is regarded as more or less complete and certainly representative of the habitats present. On the other hand, the Garden has enormous potential for allowing additional species to become established in the future. In view of the enormous numbers of garden pests devoured by many species of hoverfly, the potential benefits are self-evident. The creation of a saproxylic resource is one easy and obvious conservation step that could be taken towards improving an element of the overall insect fauna that is generally impoverished in this part of London. At present, practically all garden refuse, including any dead wood, is taken to the Recycling Centre where it is shredded and composted; larger timber units are also removed. The retention of both large and small tree branches at the backs of shrubberies or in other places where they are out of sight would have positive benefits in terms of the overall ecology of the Garden. The retention of stumps of trees that are felled would likely encourage further species, though the stumps would not have to be chemically poisoned. 'Rustic' fencing and other barriers, created from trunks and large branches, would also provide a further saproxylic resource that would be of benefit to a wide rage of insects in addition to hoverflies — none of them pests and several of them positively beneficial to gardens.

Wetland is harder to both create and maintain, but a 'bog garden' or similar, particularly if native waterside plants could be established, might also make an aesthetically pleasing attraction. Such a feature could be usefully created at the western end of The Lake, perhaps near The Waterfall, by allowing the bank to slope more gradually into the water and by establishing a shallow, submerged shelf here.

Acknowledgements

I am particularly grateful to Mark Lane, the Head Gardener at the Palace, for his unstinting assistance in all aspects of the survey (not least for suffering the indignity of an entomologist digging holes for pitfall traps in his lawn areas!). It is also appropriate to thank the several police officers stationed in Buckingham Palace Garden. In spite of their primary concern for security, which is generally contradictory to long-haired, bearded types lurking in the undergrowth and popping up, unexpected, they have shown tremendous cooperation with the overall field survey. I am also grateful to David Carter, Natural History Museum, London, who made regular trips to the Garden to change the pot on the Malaise trap and who stored these until I was able to collect them for sorting. Finally, I must thank my friends Peter Chandler, Del Smith, Alan Stubbs and Martin Speight for reading through the manuscript version of this paper and for making a number of helpful comments and suggestions.

In order to avoid any ethical conflict arising from me presenting a paper in a peer-reviewed publication of which I am, myself, the editor, I have accepted and incorporated the comments and criticisms of these gentlemen without question.

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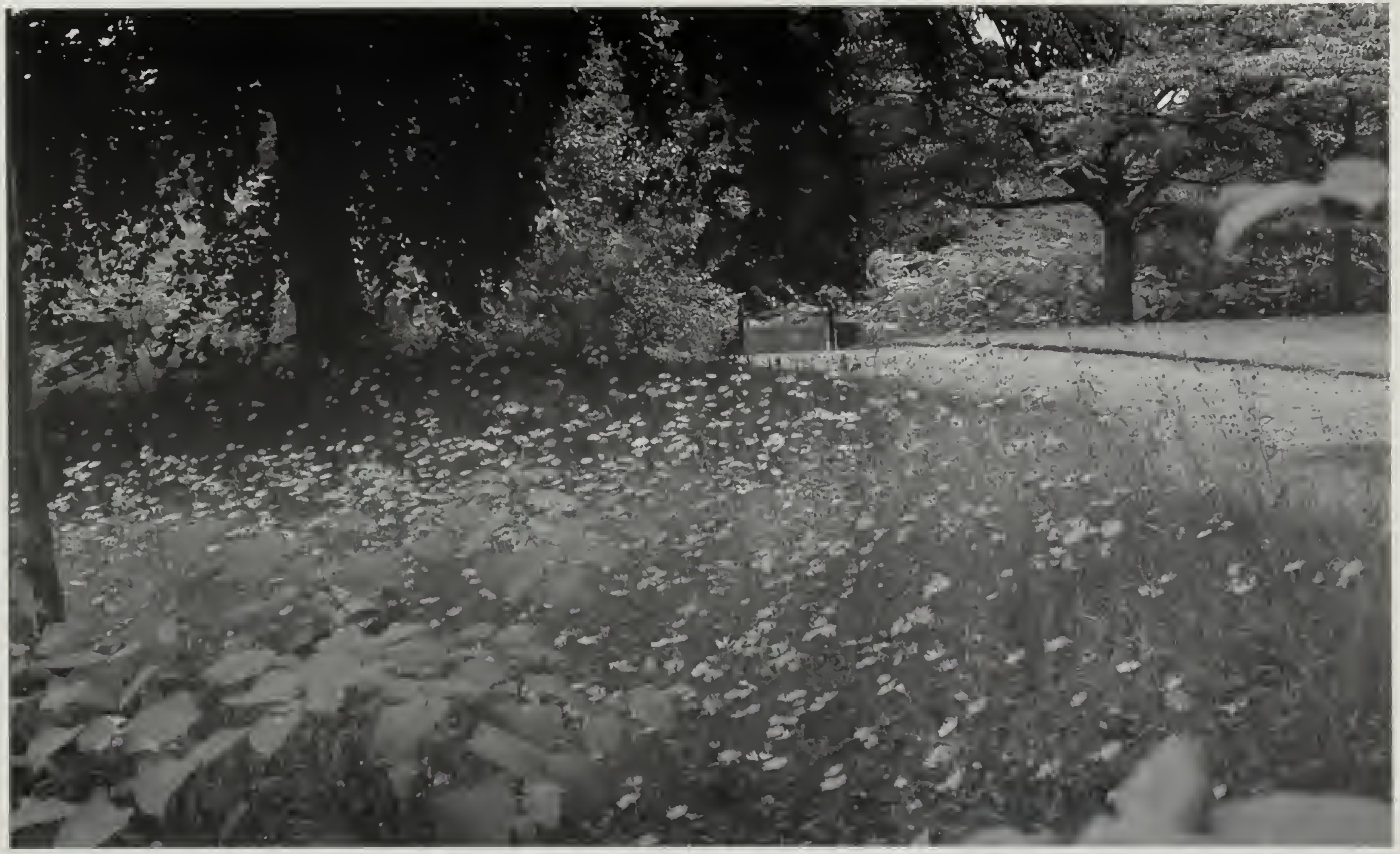

PLATE L. Buckingham Palace Garden, London. Wild flowers permitted to grow in some grassy areas provide a source of pollen and nectar for hoverflies, solitary bees and many other insects.
Photographed © by Mark Lane

The bees, wasps and ants (Hymenoptera: Aculeata) of Buckingham Palace Garden

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Abstract

Aculeate Hymenoptera were collected between 1995 and 1998 at Buckingham Palace Garden in Malaise and pitfall trap samples and by minimal active collecting. A total of 89 species was recorded and an annotated list is presented. This is considered to provide a reasonable representation of the aculeate fauna present.

Introduction

Six species of aculeate Hymenoptera were recorded from Buckingham Palace Garden by Richards (1964). The 1995 to 1998 survey records 89 species, of which four were recorded in the earlier work, so that the overall total of aculeates recorded from the Garden is now 91 — about 16% of the British aculeate fauna. This total is, in all probability, representative of the number of species that might be expected in a large ornamental garden at the centre of a large conurbation, but certainly considerably less than would be expected from a less managed or tidy environment, or from wasteland sites of comparable size in London. This is examined further in the discussion.

Collecting methods

Passive sampling

The results are almost exclusively the product of the Malaise trap, and to a much smaller extent, pitfall traps run between 1995 and 1997. The Malaise trap was operated on The Mound [see map on pages 2 & 3 of this *Supplement*, grid square 09], for the entire duration of the survey. Samples from the trap were all passed to Colin Plant, who sorted and extracted the various taxa and passed them to the identifiers. This generated most of the records of aculeate Hymenoptera. Pitfall traps set by Colin Plant were operated at six stations, and again the few aculeates were sorted and passed to me by him.

Active sampling

Unfortunately almost no active sampling has been carried out for aculeate Hymenoptera during the current survey. Colin Plant did some active collecting of aculeates on 5 July 1996, and the resulting specimens were passed to me for identification. From the eleven species collected this resulted in no less than five that were not collected by Malaise or pitfall traps throughout the whole survey. This suggests that other species may remain unrecorded and these could best be found using active fieldwork throughout the season.

Discussion

Habitats and ecological requirements

Adult aculeate Hymenoptera require suitable nectar sources and many bee species require specific plant species to provide pollen to stock their cells. Flowerbeds and flowering shrubs provide valuable forage for various bees if they contain suitable plant species. The planting of hawthorn (*Crataegus* spp.) in the garden is very favourable to a number of spring and early summer bee species, which will use the blossom as a nectar and pollen source. Predatory wasps require suitable hunting areas that provide the specific prey-species and a number of wasp species successfully use 'woodland edge' habitat in gardens. Aculeates also require suitable nesting areas. For many, this involves the availability of bare ground, usually sandy, sometimes firm, sometimes loose and in various aspects ranging from flat ground to vertical banks. The mining bee *Andrena fulva* is particularly frequent in gardens. It prefers light soils in warm and sunny situations, including well-trodden paths, on lawns and other short cropped or sparsely vegetated areas (Falk 1991). Other mining bees common in garden situations include the *Andrena bicolor, A. fulva, A. nigroaenea* and their cleptoparasites *Nomada fabriciana*, *N. fulva, N. marshamella* and *N. goodeniana.* Then there are species of bees and wasps which nest in the dead stems of scrub and herbaceous plant species and in standing dead trees and old fence posts in sunny situations. In residential situations, some species of cavity nester may be frequent. Old walls, eaves and dead timber in gardens often provide suitable cavities for common species such as the mason bee *Osmia rufa,* the leaf cutter bees *Megachile centuncularis* and *M. willughbiella,* the small halictine bee *Lasioglossum smeathmanellum* and the yellow-faced bee *Hylaeus communis*. The cleptoparasitic ruby-tailed wasps *Chrysis angustula* and *C. ignita* agg. are also fairly frequent in one or more of these situations where their hosts are established.

It is difficult to definitively categorise the nest sites used by all the species recorded in Buckingham Palace Garden, since some species will use a range of available cavities, including burrows in the soil, stems, and pre-formed burrows in mortar, dead wood and masonry. However, approximately 36% are typically ground nesters, 51% aerial or cavity nesters and 13% are parasitic or cleptoparasitic on other species. Whilst many gardening activities will never allow the long-term establishment of suitable nesting habitat for most aculeates, the numbers of species collected in the Malaise trap samples suggests there must be beneficial nesting, foraging and hunting areas present somewhere within Buckingham Palace Garden. Nest sites have to be relatively undisturbed through the season and from one year to the next to ensure the survival of larvae and pupae and the continuity from one generation to the next. Although intermittent surface disturbance is frequently important in the maintenance of the bare ground favoured by many ground-nesting species, the annual digging of ground for the planting of herbaceous flower beds and vegetable plots will not allow the survival of ground nests. Aculeate species are, therefore, only likely to nest successfully in relatively undisturbed banks and corners of gardens, but these undisturbed areas are not unusual and in a garden of this size various areas may remain undisturbed for twelve months or more; this continuity of habitat is extremely beneficial to the populations of aculeates. The regular pruning and tidying up of dead flowers and the removal of seed-heads and dead stems will prevent the establishment of stem nesting species, but careful pruning of shrubs and hollow stem plants can provide important nesting sites if these stems are allowed to over-winter until the next season. Re-pointing and cleaning of old walls and the replacement of old fences, also removes nesting habitat for cavity nesting species favouring cavities. Dead tree trunks are often removed in gardens, but if these are left *in situ* to age, they are usually extremely beneficial to a whole range of invertebrates.

The recorded fauna

It is quite unusual to have regular survey data over a duration of three years. Analysis can be used to assess the likely completeness of the recorded aculeate Hymenoptera list. An accumulation graph of the numbers of species recorded over the survey period (Figure 1) suggests that the total is still rising and more species remain to be found. On the other hand this may be due to the capture of casual wanderers from outside the Garden, but this is an effect that is difficult to assess.

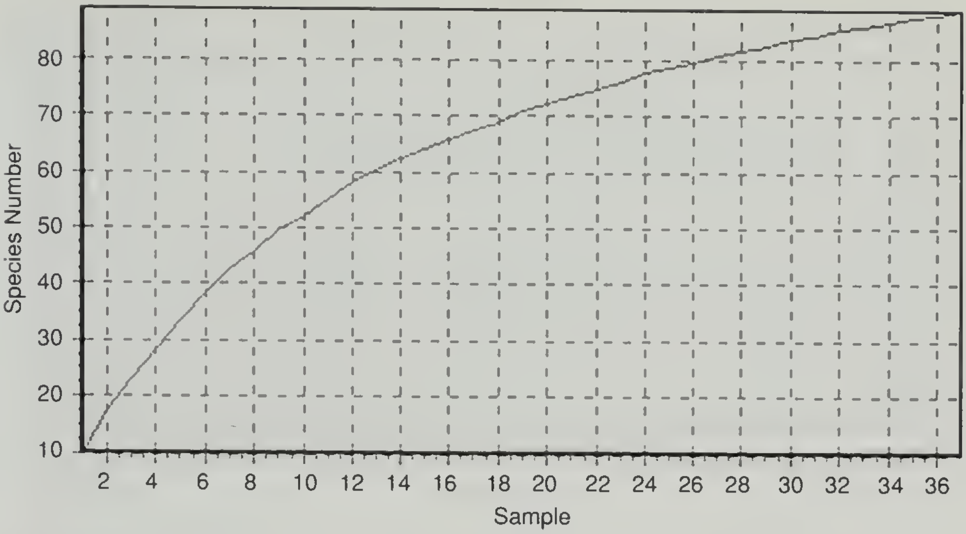

FIGURE 1. Graph of the numbers of species recorded over the survey.

The smaller number of regularly recorded species also implies the total is overestimated. Of the 89 species recorded during the current survey, only twenty-six species were recorded in every year of the survey (Table 1). On the other hand the number of new species recorded on the one occasion when active field sampling was undertaken suggests further species remain unrecorded. Twenty-six species were recorded only once throughout the whole survey period. This may indicate that these species are either present at a low population levels, are very localised within the gardens, or are not resident in the gardens, but casual visitors from other areas such as St James Park, Hyde Park or Kensington Gardens. On the other hand it may reflect the limited survey methods used to record the aculeate hymenoptera during this project. Eighteen species were recorded as a single individual only once throughout the whole survey period, and might be interpreted as casual to the gardens. If these are removed from the sample, the accumulation graph now looks like Figure 2. This suggests the species total might be levelling off at something over seventy species. Data on the number of occasions species were recorded during the survey is summarised in Table 1.

Number of occasions each species was recorded	**1995**	**1996**	**1997**	**Over whole survey period 1995–97**
Species recorded on 1 occasion	19	27	28	26
Species recorded on 2 occasions	18	16	11	12
Species recorded on 3 occasions	5	6	4	12
Species recorded on 4 occasions	4	5	4	10
Species recorded on 5 or more occasions	43	35	42	29
Total number of species recorded during the current survey				**89**
Number of species recorded every year of the survey				26
Number of species recorded as a single individual, only once during the whole survey period				18

TABLE 1. Numbers of species recorded during the survey period. An occasion is defined here to be from one Malaise or pitfall trap sample period or a single date.

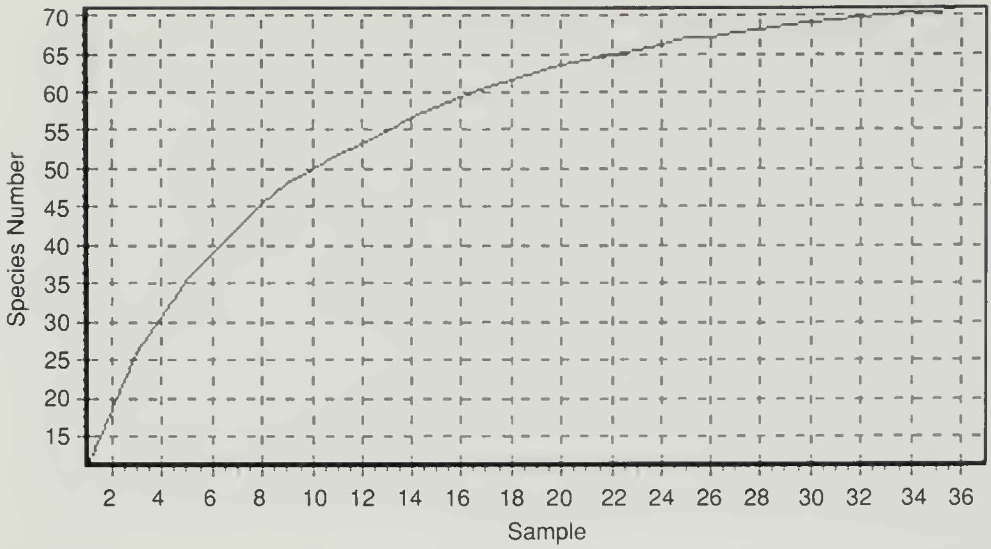

FIGURE 2. Graph of the numbers of aculeate species recorded over the survey, with species recorded as a single individual only once during the three year survey removed from the sample.

Few sites in the London area have been surveyed for aculeate Hymenoptera, and very little data published. Yeo (1957) and Felton (1967) published results of collecting at Bushy Park and Hampton Hill, Middlesex. In total, 121 species were recorded. Guichard (1938, 1939) published results of a survey at Limpsfield Common, and recorded ninety species; the author expected that the species total should be at least 150 when the area had been worked properly. Yarrow (1940) and Guichard & Yarrow (1947) published results for Hampstead Heath, with a list of 216 species of which more than 150 were recorded during the century of publication. Morris (1997) records 182 species of aculeate Hymenoptera for Mitcham Common, based on most extensive recording in the period 1990-1992, but extending back to the late 1970s. All these sites are likely to be far richer than large gardens, where the diversity and range of relatively unmanaged habitats is simply not represented. Against this background, the fauna recorded during the current survey of Buckingham Palace Garden appears to be quite representative of what could be expected of a large garden in central London, although it does include, perhaps unexpected, Nationally Scarce species such as the spider-hunting wasp *Auplopus carbonarius*, the sphecid wasps *Mimesa (Psen) bruxellensis*, *Nysson trimaculatus*, and *Lestiphorus (Gorytes) bicinctus* and the mining bee *Andrena tibialis*.

An annotated list of Hymenoptera: Aculeata recorded in Buckingham Palace Garden

Species found in the earlier survey, but not found during the present study, are shown in parentheses whilst those recorded in both surveys are indicated by an asterisk. 'Red Data Book' and 'Notable' species are those listed by Falk (1991). Nomenclature broadly follows that used in Edwards (1997, 1998, 2001) and a forthcoming checklist being compiled by the Natural History Museum; authorities are given for species names so that any confusion might be avoided. Comments on the London area status of the aculeate Hymenoptera are based on the very limited published information available and the author's experience of species distribution in the Essex, north Kent and the East Thames Corridor (Harvey 2000a).

HYMENOPTERA
ACULEATA
CHRYSIDOIDEA
BETHYLIDAE

Laelius microneurus (Kieffer, 1906)
A single specimen in the Malaise trap sample for 15 August – 5 September 1997.

CHRYSIDIDAE

Omalus auratus (Linnaeus, 1758)
A single specimen in the Malaise trap sample for 11 July – 1 August 1996.

Chrysis angustula Schenck, 1856
Fifteen specimens in Malaise trap samples during 1995, 1996 and 1997.

Cleptes semiauratus (Linnaeus, 1761)
Eight specimens in Malaise trap samples in 1995 and 1996. Notable (Nb). Almost certainly scarce in the London area.

SCOLIOIDEA
TIPHIIDAE

Myrmosa atra Panzer, 1801
A single male in the Malaise trap sample for 27 July – 3 August 1995.

FORMICOIDEA
FORMICIDAE

(*Myrmica rubra* (Linnaeus, 1758) *(as M. laevinodis* Nylander))

Myrmica sabuleti Meinert, 1861
Sixteen workers in a pitfall trap in 1997.

Myrmica scabrinodis Nylander, 1846
One alate female in a pitfall trap between 5 September and 21 October 1996.

Lasius niger sensu lato
Ten workers and one alate female in Malaise trap samples and one pitfall sample in 1995, 1996 and 1997.

(*Lasius umbratus* (Nylander, 1846))

POMPILOIDEA
POMPILIDAE

Dipogon variegates (Linnaeus, 1758)
Two females were taken in the Malaise trap sample for 18 July – 13 August 1997.

Auplopus carbonarius (Scopoli, 1763)
Two females taken in Malaise trap samples for 18 –27 June 1996 and 11 July – 1 August 1996. Notable(Nb). Rare in London, but possibly under-recorded.

Agenioideus cinctellus (Spinola, 1808)
One female taken in Malaise trap between 15 August and 5 September 1996.

Arachnospila anceps (Wesmael, 1851)
Four males and one female taken in Malaise trap samples for 27 July – 3 August 1995, 24 – 31 August 1995 and 6 – 18 June 1996.

VESPOIDEA
VESPIDAE

EUMENINAE

Ancistrocerus gazella (Panzer, 1798)
One male and three females taken in Malaise trap samples for 7 May – 30 June 1995 and 15 May – 19 June 1997. Two females collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Ancistrocerus trifasciatus (Müller, 1776)
Eight females taken in the Malaise trap sample for 15 May – 19 June 1997.

Symmorphus mutinensis (Baldini, 1894)
Three females taken in Malaise trap samples for 20 May – 23 June 1995, 30 June – 7 July 1995 and 11 July – 1 August 1996.

VESPINAE

Dolichovespula media (Retzius, 1783)
Seven workers taken in Malaise trap samples for 7 – 20 May 1995, 27 July – 3 August 1995, 15 August – 21 October 1996. Notable (Na). First recorded in Britain in 1980, this wasp is now relatively widespread and common in England, northwards to Cumbria and Durham (Archer *et al.*, in Edwards, 1995).

Dolichovespula norwegica (Fabricius, 1781)
A single worker in the Malaise trap sample for 18 July – 13 August 1997.

Dolichovespula sylvestris (Scopoli, 1763)
A single male in the Malaise trap sample for 20 – 28 July 1995 and a single queen in the Malaise trap sample for 25 April – 9 May 1996.

Dolichovespula saxonica (Fabricius, 1793)
Two males in the Malaise trap sample for 3-10 August 1995. RDBK. First recorded in Britain in 1987, this wasp has extended its range as far north as Norfolk (Archer *et al.*, in Edwards, 1995).

Vespula germanica (Fabricius, 1793)
Common in Malaise trap samples between April and November throughout the survey, but less so than *V. vulgaris*.

Vespula vulgaris (Linnaeus, 1758)
Common in Malaise trap samples between April and November throughout the survey.

SPHECOIDEA

SPHECIDAE

Trypoxylon attenuatum Smith, F., 1851
Five females taken in Malaise trap samples during 1995 and 1996.

Trypoxylon clavicerum Lepeletier & Serville, 1828
One male and three females taken in Malaise trap samples during 1995 and 1996.

Trypoxylon medium de Beaumont, 1945
One female taken in the Malaise trap sample for 23 – 30 June 1995.

Crossocerus annulipes (Lepeletier & Brullé, 1834)
One male and twenty females taken in Malaise trap samples during 1995 and 1996.

Crossocerus distinguendus (Morawitz, A., 1866)
Two males and eighteen females taken in Malaise trap samples during 1995, 1996 and 1997. Notable (Na). Now fairly widespread in much of south-east England.

Crossocerus elongatulus Vander Linden, 1829)
Four females taken in Malaise trap samples during 1995, 1996 and 1997, and one male collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Crossocerus ovalis Lepeletier & Brullé, 1834
One male and two females taken in Malaise trap samples during 1995.

Crossocerus podagricus (Vander Linden, 1829)
One male and two females taken in Malaise trap samples during 1996.

Crossocerus pusillus Lepeletier & Brullé, 1834
Three females taken in Malaise trap samples during 1995.

Crossocerus quadrimaculatus (Fabricius, 1793)
Four males and twelve females taken in Malaise trap samples during 1995, 1996 and 1997.

Crossocerus tarsatus (Shuckard, 1837)
Two females, one taken in the Malaise trap sample for 1 – 15 August 1996 and one 15 August – 5 September 1996.

Ectemnius cavifrons (Thomson, 1870)
Two males and nine females taken in Malaise trap samples during 1995, 1996 and 1997.

Ectemnius cephalotes (Olivier, 1792)
Four males and thirty-seven females taken in Malaise trap samples during 1995 and 1996.

Ectemnius lituratus (Panzer, 1804)
Two males and two females taken in Malaise trap samples during 1995, 1996 and 1997.

Rhopalum clavipes (Linnaeus, 1758)
Three males and two females taken in Malaise trap samples during 1995, 1996 and 1997.

Rhopalum coarctatum (Scopili, 1763)
One male and two females taken in Malaise trap samples during 1996 and 1997.

Mimesa bruxellensis Bondroit, 1934
One female taken in the Malaise trap sample for 1 – 15 August 1996. Notable (Na). Scarce in the London area, but collected in Thamesmead in 1997 by the author and C.W. Plant and recorded from Bushy Park (Yeo, 1956). The species might occur in other Royal Parks.

Mimesa lutaria (Fabricius, 1787)
One female taken in the Malaise trap sample for 18 July – 13 August 1997.

Psenulus pallipes (Panzer, 1798)
Three males and five females taken in Malaise trap samples during 1995 and 1996.

Stigmus pendulus Panzer, 1804
Seventy-four adults of both sexes taken in malaise trap samples during 1995, 1996 and 1997. RDBK. First recorded in Britain in 1986, this wasp is now known to be widespread in south-eastern England.

Pemphredon inornatus Say, 1824
One female taken in the Malaise trap sample for 20 May – 23 June 1995.

Pemphredon lugubris (Fabricius, 1793)
One male and twelve females taken in Malaise trap samples during 1995, 1996 and 1997.

Passaloecus corniger Shuckard, 1837
Five females taken in Malaise trap samples during 1995, 1996 and 1997.

Passaloecus gracilis (Curtis, 1834)
Two males and twenty-six females taken in Malaise trap samples during 1995, 1996 and 1997.

Passaloecus singularis Dahlbom, 1844
Three females taken in Malaise trap samples during 1995.

Mellinus arvensis (Linnaeus, 1758)
One female taken in the Malaise trap sample for 10 – 17 August 1995.

Nysson trimaculatus (Rossius, 1790)
Twelve females taken in Malaise trap samples during 1995, 1996 and 1997. Notable (Nb). Reasonably widespread in sandy and post-industrial sites with some scrub in the east Thames region and in south-west London and Surrey heathlands. It has been recorded from a roadside hedge in central London (Edwards & Telfer 2001).

Lestiphorus (Gorytcs) bicinctus (Rossius, 1794)
One female taken in the Malaise trap sample for 10-17 August 1995. Notable (Nb). Reasonably widespread but scarce in sandy and post-industrial sites in the east Thames region, as well as southwest London and Surrey (see map in Edwards & Telfer 2001).

APOIDEA

APIDAE

COLLETINAE

Colletes daviesanus Smith, F., 1846
Two males and two females collected by C.W. Plant on 5 July 1996 in the Silver garden area.

Hylaeus brevicornis Nylander, 1852
One male taken in the Malaise trap sample for 11 July – 1 August 1996.

Hylaeus communis Nylander, 1852
Seven males and four females taken in Malaise trap samples during 1995, 1996 and 1997.

Hylaeus hyalinatus Smith, F., 1842
One male collected by C.W. Plant on 5 July 1996.

ANDRENINAE

Andrena bicolor Fabricius, 1775
One male and four females taken in Malaise trap samples during 1995 and 1996, and one male collected by C.W. Plant on 5 July 1996 in the Silver Garden area.

Andrena fulva (Müller in Allioni, 1766)
One male taken in the Malaise trap sample for 27 March – 24 April 1997 and one female in the Malaise trap sample for 24 April – 15 May 1997.

Andrena haemorrhoa (Fabricius, 1781)
Four males and thirteen females taken in Malaise trap samples during 1995, 1996 and 1997.

Andrena minutula (Kirby, 1802)
One male and two females collected by C.W. Plant on 5 July 1996 in the Silver Garden area.

Andrena nigroaenea (Kirby, 1802)
Three males and seven females taken in Malaise trap samples during 1996 and 1997.

Andrena nitida (Müller, 1776) [*Andrena pubescens* Olivier, 1789]
Two females taken in Malaise trap samples during 1997.

Andrena semilaevis Pérez, 1903 [= *Andrena saundersella* Perkins, R.C.L., 1914]
Six males and seven females taken in Malaise trap samples during 1995, 1996 and 1997.

Andrena scotica Perkins, R.C.L., 1916
Four females taken in Malaise trap samples during 1996 and 1997.

Andrena synadelpha Perkins, R.C.L., 1914
One male taken in the Malaise trap sample for 15 May – 19 June 1997.

Andrena tibialis (Kirby, 1802)
One male was taken in a Malaise trap sample dated 16 April 1997. Notable (Na). The species is scarce, but possibly widespread, in the east Thames and London areas.

HALICTINAE

Lasioglossum calceatum (Scopoli, 1763)
One male taken in the Malaise trap sample for 1 – 15 August 1996.

Lasioglossum leucopus (Kirby, 1802)
Two females taken in the Malaise trap sample for 18 July – 13 August 1997.

Lasioglossum malachurum (Kirby, 1802)
Three males taken in Malaise trap samples for 10 – 17 August 1995 and 17 – 24 August 1995. Notable (Nb). This species is widespread and frequent in much of the East Thames Corridor and Essex (Harvey 2000b) and is widespread in Surrey (Baldock & Collins 2000). It is probably widespread in other parts of the London area.

Lasioglossum morio (Fabricius, 1793)
Nine males and twenty-two females taken in Malaise trap samples during 1995, 1996 and 1997.

Lasioglossum parvulum (Schenck, 1853)
One male taken in the Malaise trap sample for 20 May – 23 June 1995 and one male taken in the Malaise trap sample for 20 – 28 July 1995.

Lasioglossum smeathmanellum (Kirby, 1802)
Four females taken in Malaise trap samples during 1995 and 1997.

Lasioglossum villosulum (Kirby, 1802)
Two males and two females taken in Malaise trap samples during 1995, 1996 and 1997.

Sphecodes geoffrellus (Kirby, 1802) [= *Sphecodes fasciatus* von Hagens, 1882]
One female taken in the Malaise trap sample for 3 – 10 August 1995.

Sphecodes puncticeps Thomson, 1870
One male taken in the Malaise trap sample for 17 – 24 August 1995.

MEGACHILINAE

Anthidium manicatum (Linnaeus, 1758)
Two males and two females collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Osmia rufa (Linnaeus, 1758)
Nine males and eighteen females taken in Malaise trap samples during 1996 and 1997.

Megachile centuncularis (Linnaeus, 1758)
One male taken in the Malaise trap sample for 6 – 18 June 1996, one female taken in the Malaise trap sample for 7 – 20 May 1995 and one male collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Megachile ligniseca (Kirby, 1802)
One male collected by C.W. Plant on 5 July 1996 in the Silver Garden.

Megachile willughbiella (Kirby, 1802)
Two males collected by C.W. Plant on 5 July 1996 in the Silver Garden, one female taken in the Malaise trap sample for 7 – 20 May 1995 and one female taken in the Malaise trap sample for 20 May – 23 June 1995.

APINAE

Nomada flava Panzer, 1798
Four females taken in the Malaise trap sample for 23 May – 6 June 1996 and two females taken in the Malaise trap sample for 24 April – 15 May 1997.

Nomada flavoguttata (Kirby, 1802)
One female taken in the Malaise trap sample for 6 – 18 June 1996, one female taken in the Malaise trap sample for 18 – 27 June 1996 and one female taken in the Malaise trap sample for 24 April – 15 May 1997.

Nomada goodeniana (Kirby, 1802)
Two males taken in the Malaise trap sample for 11 – 25 April 1996 and one male in a sample dated 16 April 1997.

Nomada ruficornis (Linnaeus, 1758)
Two males and two females taken in Malaise trap samples during 1997.

Anthophora plumipes (Pallas, 1772)
Nineteen males and five females taken in Malaise trap samples during 1996 and 1997.

Bombus hortorum (Linnaeus, 1761)
Eleven males, eight queens and eleven workers taken in Malaise trap samples during 1995, 1996 and 1997.

Bombus lapidarius (Linnaeus, 1758)
One male, three queens and five workers taken in Malaise trap samples during 1995, 1996 and 1997.

Bombus lucorum (Linnaeus, 1761)
One male, twenty-three queens and twenty-six workers taken in Malaise trap samples during 1995, 1996 and 1997.

Bombus pascuorum (Scopoli, 1763)
Common in Malaise trap samples between May and September during 1995 and 1996, less frequent in samples during 1997.

Bombus pratorum (Linnaeus, 1761)
Ten males, eleven queens and fifteen workers taken in Malaise trap samples during 1995, 1996 and 1997.

Bombus terrestris (Linnaeus, 1758)
One male, eleven queens and seventeen workers taken in Malaise trap samples during 1995, 1996 and 1997.

Apis mellifera Linnaeus, 1758
Twenty-six workers taken in Malaise trap samples during 1995 and 1997.

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The sawflies (Hymenoptera: Symphyta) of Buckingham Palace Garden

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Abstract

A survey of sawflies (Hymenoptera: Symphyta) occurring in The Garden at Buckingham Palace during 1995-98 produced a total of 31 species, with one additional species added in 2000. The species assemblage contains a high proportion of those likely to occur as garden pests.

Introduction and methods

The Garden was visited on 13 August 1997, 9 September 1997 and 1 June 1998 and specimens were also received from a Malaise trap sited on The Mound from 20.iv.1995 to 18.viii.1997. The mown lawn areas of Buckingham Palace Garden were judged likely to support few sawflies, but the flower beds, semi-wild areas and the lake margins all provide habitats for the plant-feeding larvae of these insects.

Sawflies were collected during the visits by sweeping vegetation with a net and by searching plants for larvae or signs of feeding activity. Wild and cultivated plants known to have sawflies associated with them were targeted for close attention. Identifications of adult insects were made using the keys of Benson (1952 and 1958) and Quinlan and Gauld (1981). Some larval stages were identifiable by their appearance or the distinctive feeding damage that they cause on certain host plants. Other larvae were retained and, where possible, they were reared through to the adult stage to ensure correct identification.

Results

During the 1995-98 period of the survey, 31 species of sawfly were identified as either adults or larvae, or from evidence of larval feeding. Of these, ten were recorded in the Malaise trap only, 16 by sweeping for adults and searching for larvae or feeding damage, and five species were recorded by both methods. Twelve of these are commonly found in gardens as pests of cultivated plants (Alford, 1991). Most of the sawflies recorded are common species found widely in Britain, but two species, *Neurotoma saltuum* and *Pristiphora geniculata*, are of local occurrence. The former was noted after the formal survey period ended, but is included in the species list.

Discussion

During the previous survey, conducted in the early 1960s, sawflies were not specifically recorded, although four species were casually noted as leaf-mines, galls or larvae (Richards 1964). Two of these species, *Heterarthrus vagans* and *Nematus caeruleocarpus*, were not seen during the current survey. For a garden the size of that at the Palace, and with its diversity of plants, a total list of 34 species is not large. More extensive collecting in the spring-midsummer period would almost certainly increase the list, as there is a number of common species that have not yet been recorded. Some quite large genera, such as *Empria, Macrophya, Tenthredo, Amauronematus* and *Pachynematus* have no representative recorded at the Palace, although some species in these genera are common species and likely to be present.

An annotated list of Symphyta recorded in Buckingham Palace Garden

The sequence of species and nomenclature follow Liston (1995); where names have changed from those given in the identification keys, the latter name is given in square brackets after the current name. Species found in the earlier survey, but not in the present study, are enclosed in round brackets. Taxa recorded in both surveys are indicated with an asterisk (*). Taxa with neither annotation were found for the first time in the present survey.

HYMENOPTERA: SYMPHYTA

PAMPHILIIDAE

PAMPHILIINAE

Neurotoma saltuum (L., 1758) The Social Pear Sawfly.

Recorded as larvae on *Crataegus monogyna* by Mark Lane in July 2000. This species has orange-yellow gregarious larvae that live in a communal silk web. It is of widespread occurrence in southern England, but infrequently seen. It also feeds on pear foliage, hence its common name, and so is as likely to be found in gardens as in the countryside.

ARGIDAE

ARGINAE

Arge pagana (Panzer, 1798)

One of the large rose sawflies. Larvae were found on a wild rose, *Rosa* sp., on The Mound, 9.ix.1997 — adult emerged 4.vi.1998. The gregarious larvae defoliate rose stems, as does the very similar *A. ochropus*, which was not found during the survey. *A. pagana* has become much more abundant during the latter half of the 1990s.

TENTHREDINIDAE

DOLERINAE

Dolerus aeneus Hartig, 1837

A common grassland species with larvae likely to be feeding on *Poa* spp. in the Palace Garden. One male in the Malaise trap, 22.v-6.vi.1996.

Dolerus niger (L., 1767)

A common grassland species with larvae feeding on various grasses. One female in the Malaise trap, 15.v-19.vi.1997.

Aneugmenus padi (L., 1758)

A common sawfly with larvae on ferns, especially bracken, *Pteridium aquilinum*. A female in the Malaise trap, 20-28.vii.1995.

Selandria serva (Fabr., 1793)

A common sawfly in damp grassland. Males swept near The Lake on 13.viii.1997 and 1.vi.1998. The larva feed on various grasses and sedges.

BLENNOCAMPINAE

(*Heterarthrus vagans* (Fallén, 1808))

Mines in the leaves of alder, *Alnus glutinosa*, identified by K. A. Spencer, were recorded in the earlier survey, but this species was not detected during 1995-98. It is likely that it occurs still in the Palace Garden as it is a fairly common sawfly and there is adequate alder around The Lake.

Phymatocera aterrima (Klug, 1816) Solomon's Seal Sawfly.

Identified from oviposition scars and larval feeding damage on its host plant, *Polygonatum hybridum*, near The Waterfall, on 13.viii.1997.

Blennocampa phyllocolpa Viitasaari & Vikberg, 1985 [= *B. pusilla* Klug] Rose Leaf-rolling Sawfly.

A common sawfly on wild and cultivated roses, recorded as larval leaf-rolls, on 13.viii.1997.

Halidamia affinis (Fallén, 1807)

A widespread sawfly with larvae feeding on goosegrass, *Galium aparine*. A female in the Malaise trap, 7-20.v.1995.

* *Fenusa dohrnii* (Tischbein, 1846)
Identified by K. A. Spencer in the earlier survey, this common leaf-miner on *Alnus glutinosa* was found on alders around The Lake. Mined leaves were collected 13.viii.1997 and adults emerged later that month.

ALLANTINAE

Athalia cordata Lepeletier, 1825
A common species with larvae feeding on bugle, *Ajuga reptans*. A male was swept at The Waterfall end of The Lake on 13.viii.1997 and a female was taken in the Malaise trap, 20-28.vii.1995.

A. liberta (Klug, 1815)
A common species with larvae feeding on various wildflowers of the Cruciferae family. Two females in the Malaise trap, 20.v-23.vi.1995.

Caliroa cerasi (L., 1758) Pear and Cherry Slugworm.
A common garden species that skeletonises the foliage of *Prunus, Pyrus* and some other Rosaceae trees and shrubs. Larvae were found on cherry, *Prunus* sp., leaves near The Lake, 13.viii.1997.

C. varipes (Klug, 1816)
A common species, with larvae that skeletonise the foliage of *Quercus, Salix* and *Betula*. Larvae were found on the foliage of oak, *Quercus robur*, in the Nursery Yard on 13.viii.1997; a female was reared on 16.vi.1998.

Monostegia abdominalis (Fabr., 1798)
A widely distributed species near ponds, lakes and waterways where the larvae eat the foliage of yellow loosestrife, *Lysimachia vulgaris*. Larvae were found on the host plant by The Lake margin on 9.ix.1997 and a female was found 1.vi.1998.

Ametastegia carpini (Hartig, 1837) [= *Protoemphytus carpini*] The Geranium Sawfly.
The larvae eat holes in the foliage of wild and cultivated *Geranium* spp. Larvae were found on *Geranium pratense* in flower beds by the Back Path behind The Mound on 13.viii.1997.

TENTHREDININAE

Eriocampa ovata (L., 1761)
A common species that feeds as larvae on alder, *Alnus glutinosa*. Larvae and an adult female were seen 13.viii.1997 on alders by The Lake.

Tenthredopsis litterata (Geoffroy, 1785)
A common species, with larvae that feed on various grasses. Three females were collected in the Malaise trap during June-July 1995.

T. nassata (L., 1767)
A common species with habits similar to *T. litterata*. One female was taken in the Malaise trap in June 1995.

Pachyprotasis rapae (L., 1767)
A common species with polyphagous larvae. Seven females were taken in the Malaise trap during May-June 1996, three males and two females during May-June 1997 and one female was swept 1.vi.1998.

NEMATINAE

Priophorus pallipes (Lepeletier, 1823)
A common species with larvae feeding on the foliage of various Rosaceae trees and shrubs. A male and female were taken in the Malaise trap in June 1995.

P. rufipes (Lepeletier, 1823)
One of the more abundant sawflies in the Palace Garden in terms of numbers captured in the Malaise trap. The larvae feed on elm leaves, *Ulmus procera*. One male was recorded in June 1995, three males in 15.v-19.vi.1997 and 17 males and one female in 18.vii-13.viii.1997.

Trichiocampus ulmi (L., 1758) [= *Priophorus ulmi* L.]
Similar in habits to *P. rufipes*, but less common. One female and two males in the Malaise trap during 15.viii-5.ix.1995.

Cladius pectinicornis (Geoffroy, 1785)
A common sawfly with larvae that feed on rose leaves, *Rosa* spp. Two males in the Malaise trap, 20.v-23.vi.1995 and another male swept on 1.vi.1998.

Hoplocampa testudinea (Klug, 1816) The Apple Sawfly
The larvae feed inside the developing fruitlets. Signs of larval feeding in the fruits were seen on apples growing in the old orchard on 13.viii.1997 and 1.vi.1998.

Pristiphora aquilegiae (Vollenhoven, 1866) [= *P. alnivora* (Hartig)], The Aquilegia Sawfly
A widespread garden pest with larvae that can defoliate *Aquilegia* spp. Larvae were found on *Aquilegia* plants on 13.viii.1997 and a male was swept on 1.vi.1998.

P. armata (Thomson, 1862) [= *P. crassicornis* (Hartig)]
A widespread species, with larvae that feed on hawthorn, *Crataegus monogyna*. The Malaise trap recorded a male and female in June 1995, one male for 15.v–19.vi.1997, and a male was swept on 1.vi.1998.

P. geniculata (Hartig, 1840) The Mountain Ash Sawfly
A local but widespread sawfly in southern England. The gregarious larvae can defoliate mountain ash, *Sorbus aucuparia* and other *Sorbus* spp. with pinnate leaves. This sawfly was present on many of the pinnate-leaved *Sorbus* trees at the Palace and was causing significant damage to some of the smaller trees. Larvae were seen on 13.viii.1997 and 1.vi.1998.

* *Pontania proxima* (Lepeletier, 1823)
Galls on *Salix blanda* were recorded in the earlier survey. Galls believed to be of this species were found on *Salix alba* on 9.ix.1997, but no adults were reared. It is a common species.

(*Nematus caeruleocarpus* Hartig, 1837)
Identified by R. B. Benson in the earlier survey from larvae on *Salix* sp.

N. pavidus Lepeletier, 1823
A common sawfly that sometimes defoliates willows, *Salix* spp. A female was reared on 22.vi.1998 from larvae collected 1.vi.1998 on *Salix cinerea*. Similar larvae were found on 13.viii.1997, but no adults were reared.

N. spiraeae Zaddach, in Brische & Zaddach, 1882 The Aruncus Sawfly
A widespread garden pest of *Aruncus dioicus*, capable of causing complete defoliation. Larvae were found near The Waterfall on 13.viii.1997.

N. tibialis Newman, 1837 The False Acacia Sawfly
Like its host plant, *Robinia pseudoacacia*, this sawfly is an introduction from North America. It is of widespread occurrence in urban areas of England and was the most abundant species in the Malaise trap. It is an entirely female species; nine were taken in the trap for 7.v-10.x.1995, ten for 11.vii-15.viii.1996 and 14 for 15.v-13.viii.1997. Larvae were found on *Robinia pseudoacacia* leaves on 13.viii.1997 and an adult was swept on 1.vi.1998.

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The beetles (Coleoptera) of Buckingham Palace Garden

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Abstract

Coleoptera were collected between 1995 and 1998 at Buckingham Palace Garden. A total of 244 species was recorded. Comparisons are drawn with an earlier survey some forty years previously and an annotated list of the 287 species recorded in both surveys is presented. Though it is not possible to say that all species have been recorded at any site, this total is considered to be close to the maximum number likely to be present in this habitat in the centre of a large urban conurbation.

Introduction

The first beetle records from Buckingham Palace Garden are apparently those of F. D. Buck and E. G. Gardner (Buck 1964), who carried out a survey between 1960 and 1963, recording 91 species (not 87 as stated by Buck in his Introduction). They collected in the Garden together, though the paper was written by Buck alone so the present work refers to their list as his. Their findings were the result of hand-searching backed up by beating and sweeping where possible. They also had the use of a mercury-vapour lamp, which produced several records, but they did not employ a Malaise trap or any pitfall traps. Despite these handicaps, as they might be considered today, they produced a list of 91 species. The 1995 to 1998 survey records 244 species, of which 48 were rediscoveries of species found in the earlier work, so that the overall total of beetles recorded from the Garden is 287 — about 7 per cent of the British beetle fauna. This total is, in all probability, not far short of the actual number that might be expected in an ornamental garden at the centre of a large conurbation.

Collecting methods

Active sampling

A total of twelve visits was made by me to the Garden specifically to search for beetles; these visits were made during the months of April to September in 1997 and 1998. In addition, visits by Professor John Owen and Richard Jones, specialising in other taxa, took place throughout the study period covering every month of the year. Finally, occasional beetle specimens encountered by other members of the survey team, and by the gardening staff, were passed on to me through the agency of Colin Plant.

Hand-sieving of grass, moss, rotting fungus and especially goose droppings yielded many species. Care was taken to sample both the fresh goose droppings on the lawn areas and older material in deeper piles on the islands. The vegetable refuse and horse dung (from the Royal Mews) at the Recycling Centre was regularly sieved, with the fine sievings usually taken away from the Garden for closer scrutiny. On one special occasion, the garden staff kindly removed the heavy wooden covers from the children's sandpit to enable us to collect the beetles underneath.

Beating trays were used, with discretion, on certain flowering trees and shrubs whilst sweep nets were also used on the few areas where the grass was sufficiently tall.

The Lake, including in the central area, was extensively hand-netted by Colin Plant, wearing chest-waders, on 20 October 1995, but in spite of this exercise producing seven species of aquatic Heteroptera the only beetle encountered was a single, dead *Trechus obtusus* that had evidently fallen in and drowned. There were no water beetles. Intensive sampling carried out around the edge and by examining submerged plants on 11 May 1998 also produced no true water beetles, though the area in close proximity proved to be rich in other groups, particularly when sieving moss and splashing the bank with water. There was a notable absence of aquatic plants and together with the high population of waterfowl this seems to indicate minimal entomological interest. The situation must have been the same at the time of the earlier survey, since Buck lists only two water beetles (*Ilybius fuliginosus* and *Haliplus immaculatus*) in spite of Gardner's interest in the group.

Passive sampling

A Malaise trap was operated on The Mound [see map on pages 2 & 3, grid square 09 — *Ed.*], for the entire duration of the survey. Samples from the trap were all passed to Colin Plant, who sorted and extracted the various taxa and passed them to the identifiers. This generated a number of useful records of beetles.

Pitfall traps set by Colin Plant were operated at six stations, also for the full term of the survey, and again beetles were sorted and passed to me by him. A smaller number of pitfall traps were set by Edward Milner to catch spiders and these, too, yielded a few beetles. Professor John Owen set a number of subterranean pitfall traps, consisting of a wire-mesh tube containing sherry as an attractant (*vide* Owen 1995). Although these added several interesting species to the list, Prof. Owen informs me that they were not as productive as they had been in certain other gardens, particularly in Surrey, where their use has revealed several species of blind, subterranean beetles to be much more common than was previously thought.

A small number of specimens was also made available from the mercury-vapour light trap operated for Lepidoptera by David Carter. Finally, small net bags containing old potatoes, then buried in the soil of selected flower beds, also provided several useful records.

Discussion

It is now forty years since the first survey of the Garden by Buck and Gardner, and during that time many great changes must have taken place in this dynamic environment, both in terms of gardening practice and in the types of plants cultivated. These will surely have had a profound effect upon the invertebrate community including the beetles.

One aspect of gardening practice is the turning of garden refuse into compost. Compost heaps are of great ecological value, especially in an ornamental garden that is, overall, rather too tidy for many invertebrates. They provide an important refuge for many species, both as adults and as larvae, and it is of significance that 25 per cent of Buck's records from the earlier survey were from this habitat. Prior to 1991, most of the green garden refuse was sent out of the Garden, though some was retained as compost heaps. Since 1991, a sophisticated recycling centre has been in operation, taking not only garden refuse but also horse faeces from the Royal Mews. However, although attracting many beetles and providing a good place to collect, it is not as good as a simple compost heap where material is left to rot down over the course of time. For example, Buck (1963) states in his introduction that two of the commonest beetles in the garden were *Pterostichus madidus* and *Calathus fuscipes*, both of which he records from a compost heap (sometimes he writes heaps suggesting that there was more than one). We caught neither species at the Recycling Centre and few of either in the Garden throughout the period of the survey. In fact we found the ground beetles (Carabidae) to be poorly represented in the Garden in terms of numbers of individuals, although we increased the number of recorded species considerably, from 15 to 33. It may be that the unknown causes of the reduction in numbers are of a temporary nature, and that populations may rise again at some future date; whether the loss of traditional compost heaps is a significant factor in this is a matter which may be resolved in future surveys. It is surely difficult for this group of beetles, in such isolated populations, to be reinforced by individuals from outside the Garden in the same way as smaller insects that fly more readily, such as *Meligethes* and *Anaspis*.

Whilst the present survey records an increase in the numbers of species in nearly all recorded families since Buck's day, it is in those species which have an association with plants, particularly with flowers, that the increase is most apparent. Buck records few such species and suggested that spraying with insecticides might be the reason, pointing out that they would be in the front line and more vulnerable than ground-living species. He is probably correct. Such beetles have shown a considerable increase in the Garden as the use of harmful chemicals has been reduced to the bare necessity. Buck records far fewer Chrysomelidae, Curculionidae, *Anaspis* and *Epuraea*, for instance, than the present survey and a complete absence of *Meligethes* species. Yet *Meligethes aeneus* is, perhaps, the commonest beetle in the Garden today.

Not only is the number of species increased but also the number of individuals, often significantly. This may be partly a consequence of the planting of hawthorn (*Crataegus* spp.) in the garden, as this attracts large numbers of insects when it is in flower. Buck commented on the absence of the Cerambycidae from the Garden, so he would doubtless be pleased to see *Grammoptera ruficornis* in large numbers on the hawthorn blossom — hopefully a precursor to rarer members of this attractive family.

At least two nationally rare beetles (species listed in the *British Red Data Book — vide* Shirt 1987), have been recorded from the Garden — *Longitarsus ferrugineus* (Chrysomelidae) and *Clitostethus arcuatus* (Coccinellidae).

Longitarsus ferrugineus is listed by Hyman and Parsons (1992) as *Endangered — Red Data Book category 1*. It was taken by Eric Gardner during the first survey, on a patch of mint (*Mentha*) in The Yard. The mint has long gone from here, but the present Head Gardener, Mark Lane, took me to a patch on the island that looked most promising. Unfortunately it did not produce the beetle on that occasion, though it could easily be present since it has a habit of dropping off the plant the instant it senses the approach of an entomologist and becomes almost impossible to find amongst the detritus at the roots of the mint.

A single example of *Clitostethus arcuatus* was sorted by Colin Plant from the Malaise trap sample collected between 27 July and 3 August 1996 (Williams 2000). The beetle is also listed by Hyman and Parsons (1992) as *Endangered* and was similarly placed in *Red Data Book* category 1 by Shirt (1987). It is associated with ivy, *Hedera helix*, and it is no surprise as this plant grows near the Malaise trap. It has always been considered rare, but recent records from Malaise traps (Welch and Dukes 1999) suggest that it may be more widespread than previously thought. However, it remains a rarity and a most unexpected capture in the centre of London.

Of the 91 species recorded by the earlier survey, 48 per cent have been found in the recent field survey. Interestingly, this is approximately the same percentage exhibited by the spiders (Milner *antea* 87). Whilst we did not specifically search out the elusive species we did have them in mind when collecting in suitable places.

Finally, one species, in the form of the large tenebrionid *Blaps mucronata*, a species noted by Buck as being 'not uncommon' in the potting sheds, but not found by us, was recently discovered 'scaring the horses' in the stables at the Royal Mews, adjacent to the Garden, during 2000 by Mark Lane — just in time to be recorded on our list.

An annotated list of Coleoptera recorded in Buckingham Palace Garden

Species found in the earlier survey, but not found during the present study, are shown in parentheses whilst those recorded in both surveys are indicated by an asterisk. 'Red Data Book' and 'Notable' species are those listed by Hyman and Parsons (1992; 1994). Nomenclature broadly follows Pope (1977) though this has been updated in places; authorities are given for species names so that any confusion might be avoided. Reference to a record by Buck refers to Buck (1964) and the date is omitted from the citation for reason of both brevity and clarity. Comments on the London Area status of the Carabidae were provided by Paul Mabbott, the London Area recorder for that family.

COLEOPTERA

Carabidae

* *Nebria brevicollis* (Fabricius, 1792)
Four specimens in a pitfall trap near The Stoneyard. Buck recorded it from stacked turfs. Common in the London Area.

Nebria salina Fairmaire & Laboulbène, 1856
A single specimen taken by Richard Jones at the edge of The Sandpit. Rare in the London Area.

* *Notiophilus biguttatus* (Fabricius, 1779)
The occasional specimen in pitfall traps in several parts of the Garden and under stones near The Recycling Centre. Buck records a single specimen running on the ground. Common in London.

Notiophilus palustris (Duftschmid, 1812)
A single specimen taken near The Stoneyard running in the sun. Common around London.

Clivina collaris (Herbst, 1784)
One specimen in a pitfall trap near The Tea House. Common around London.

Trechus obtusus Erichson, 1837
One example in a pitfall trap near The Waterfall. Not uncommon in the London Area.

* ?*Asaphidion curtum* (Heyden, 1870)
Several in pitfall traps and under stones. Not recorded under this name by Buck, however *A. flavipes* is recorded and this species was later split into three, one of which is *curtum*. Rather local around London, in damp areas.

Bembidion lampros (Herbst, 1784)
Five specimens under old wood and stones at The Stoneyard. Common in and around London.

* *Bembidion tetracolum* Say, 1823
Several in a pitfall trap near The Stoneyard. Buck records it from The Lakeside.

Bembidion guttula (Fabricius, 1792)
One specimen in the Malaise trap. Common in wet places around London.

Bembidion lunulatum (Fourcroy, 1785)
One specimen in the Malaise trap. Common in wet places around London.

Stomis pumicatus (Panzer, 1795)
Four specimens in a pitfall trap near The Waterfall. Not uncommon in the London Area.

* *Pterostichus madidus* (Fabricius, 1775)
One in an underground pitfall trap, another in The Sandpit and a single specimen in a conventional pitfall trap. Taken by Buck and Gardner under shrubs and in large numbers in a compost heap. Very common in the London Area.

Calathus erratus Sahlberg, C. R., 1827
A single specimen in an underground pitfall trap. This is the first record for the London Area since 1956.

* *Calathus fuscipes* (Goeze, 1777)
Several specimens in various pitfall traps and one at The Sandpit. Recorded by Buck and Gardner as being in large numbers under turves and in compost heaps, since that time it appears to have declined. Very common in the London Area.

Calathus melanocephalus (Linnaeus, 1758)
A single specimen taken at the edge of The Sandpit. Not uncommon in the London Area.

Platyderus ruficollis (Marsham, 1802)
One specimen taken in the Malaise trap, fairly widespread in the London Area, Nationally notable (Nb.). Common in and around London.

(*Agonum albipes* (Fabricius, 1796) (as *Agonum ruficorne*))
Recorded by Buck from under stones by The Lake and on The Cascade (Waterfall) and not seen since. Common in wet places around London.

(*Agonum dorsale* (Pontoppidan, 1753))
Recorded by Buck from turves and compost heap and not seen since. A generally common species in the London Area.

* *Amara aenea* (Degeer, 1774)
One specimen taken in a pitall trap at The Stoneyard. Recorded by Buck with no further details. Very common in the London Area.

Amara anthobia Villa, 1833
Two specimens in a pitfall trap near The Stoneyard. A recent arrival in Britain and appears to be still spreading, found mainly on sandy areas in southern England. Common around London.

(*Amara aulica* (Panzer, 1796))
Recorded by Buck from the m.v. trap and not seen since. Common around London.

Amara familiaris (Duftschmid, 1812)
Two in the m.v. light trap. Common in the London area.

Amara lunicollis Schiodte, 1837
One in a pitfall trap at The Silver Garden. Common in the London Area.

Amara similata (Gyllenhal, 1810)
One in a pitfall trap near The Waterfall. Not uncommon in the London Area.

Harpalus rufipes (Degeer, 1774)
Only one specimen was taken in the Garden, in the Malaise trap. Common in gardens in the London Area, so it is curious that it appears to be scarce here. It could be a recent arrival as Buck did not record it.

* *Harpalus affinis* (Schrank, 1781)
Occasionally in pitfall traps. One specimen recorded by Buck and Gardner without further details. Generally common in the London Area.

Harpalus rufibarbis (Fabricius, 1792)
One taken in a pitfall trap at The Stoneyard. Common in the London Area.

(*Anisodactylus nemorivagus* (Duftschmid, 1812))
One specimen recorded by Buck, with no further details. Usually associated with dry sandy heaths. Possibly an odd specimen brought in with plants, an uncommon species classed Na. This is the only record for the London Area.

* *Bradycellus harpalinus* (Serville, 1821)
One in a pitfall trap near The Waterfall and another in a piece of wood on The Island. Taken by Buck and Gardner in a compost heap. Common in wet places around London.

(*Bradycellus verbasci* (Duftschmid, 1812))
Recorded by Buck with no further details. Not uncommon in the London Area.

Acupalpus dubius Schilsky, 1888
A single specimen was sieved from a mixture of grass and moss at the side of The Lake.

Badister bipustulatus (Fabricius, 1792)
Occasionally in pitfall traps. Common around London.

Dromius meridionalis Dejean, 1825
Three specimens in the m.v. light trap.

Metabletus foveatus (Fourcroy, 1785)
A single specimen in a pitfall trap at The Silver Garden. Very common in the London Area.

HALIPLIDAE

(*Haliplus immaculatus* Gerhardt, 1877)
Buck records two specimens under Iris roots in The Lake. Not seen during the present survey.

DYTISCIDAE

Ilybius ater (Degeer, 1774)
One in the m.v. light trap.

(*Ilybius fuliginosus* (Fabricius, 1792))
Buck records two specimens, one from The Lake and the other in the m.v. light trap.

Rhantus suturalis (MacLeay, 1825)
One in the m.v. light trap.

HYDROPHILIDAE

(*Helophorus granularis* (Linnaeus, 1761))
Several at m.v. light according to Buck.

* *Helophorus obscurus* Mulsant, 1844
One specimen in a pitfall trap near The Stoneyard. Buck records several at mercury vapour light. Frequent in ponds in the London Area.

Sphaeridium marginatum (Fabricius, 1787)
Several at The Recycling Centre in horse dung from the Royal Mews. Considered to be a synonym of *S. bipustulatum* for many years, but recently reinstated.

Sphaeridium lunatum Fabricius, 1792
Several specimens in dung at The Recycling Centre.

* *Cercyon analis* (Paykull, 1798)
Three specimens sieved from moss and grass around The Lake. Buck records it from vegetable refuse and litter by The Lake.

* *Cercyon melanocephalus* (Linnaeus, 1758)
Several at The Recycling Centre in vegetable refuse. Buck records it from a duck's nest.

Cercyon haemorrhoidalis (Fabricius, 1775)
Several specimens at Recycling Centre in vegetable refuse.

(*Cercyon quisquilius* (Linnaeus, 1761))
Recorded by Buck from mercury light.

Cercyon pygmaeus (Illiger, 1801)
One specimen taken in a pitfall trap near The Waterfall.

* *Megasternum obscurum* (Marsham, 1802)
Several taken in pitfall traps at various parts of the Garden and in vegetable refuse at The Recycling Centre. Recorded by Buck as being common in compost.

Cryptopleurum crenatum (Kugelann, 1794)
One specimen of this local but widespread species in an underground pitfall trap. A Nationally Notable species.

Cryptopleurum minutum (Fabricius, 1775)
Several at The Recycling Centre in vegetable refuse and one in an underground pitfall trap.

(*Anacaena globulus* (Paykull, 1798))
Recorded by Buck in cut grass against a fence bordering The Lake and not seen since.

HISTERIDAE

Kissister minimus (Aubé, 1850)
One specimen in an underground pitfall trap.

Paralister purpurascens (Herbst, 1792)
A single specimen in a pitfall trap near The Stoneyard.

PTILIIDAE

Ptenidium formicetorum Kraatz, 1851
Several specimens sieved from a rotted, fungoid tree stump on The Mound.

Ptinella aptera (Guérin-Méneville, 1839)
Several specimens taken with the above species.

Ptinella errabunda Johnson, 1975
Several specimens taken with the above species.

* *Acrotrichis atomaria* (Degeer, 1774)
Several specimens taken with the previous species. Buck records it in compost, vegetable litter and an old duck's nest.

LEIODIDAE

Ptomaphagus medius Rey, 1889
One specimen in a pitfall trap near The Waterfall.

Ptomaphagus subvillosus (Goeze, 1777)
Several specimens in pitfall traps in various parts of the Garden and in the Malaise trap. Four specimens trapped in an old potato buried in the ground near The Waterfall.

(*Sciodrepoides watsoni* (Spence, 1813) (as *Sciodrepa watsoni*))
Buck records a male and a female in an old duck's nest containing addled and broken eggs.

Catops nigricans (Spence, 1813)
One specimen in an old, rotten potato buried in the ground near The Waterfall.

STAPHYLINIDAE

Omalium italicum Bernhauer, 1902
One in the Malaise trap.

Omalium rivulare (Paykull, 1789)
One specimen in a pitfall trap near The Tea House and one in the Malaise trap.

* *Siagonium quadricorne* Kirby, W., 1815
Two in a pitfall trap near The Stoneyard and three in the Malaise trap. Buck found it common under bark of felled elm and holly boughs. He is not correct when he states (in his introduction) that it only ever occurs under the bark of these two trees. I have found it under several other types of bark, in the south of England including elder on one occasion.

Carpelimus elongatulus (Erichson, 1839)
Three examples taken in a pitfall trap near The Waterfall.

(*Anotylus complanatus* (Erichson, 1839))
Recorded by Buck from vegetable litter.

Anotylus clypeonitens (Pandelié, 1867)
One in the m.v. light trap. A generally uncommon species.

* *Anotylus tetracarinatus* (Block, 1799)
Several in garden refuse at The Recycling Centre. Buck records it from vegetable litter at The Lakeside.

* *Anotylus rugosus* (Fabricius, 1775)
Two in the Malaise trap. Buck records it from vegetable litter and compost.

* *Stenus brunnipes* Stephens, 1833
Two in a pitfall trap at The Tea House. Buck swept one by The Lake.

Stenus canaliculatus Gyllenhal, 1827
One specimen in the Malaise trap.

Stenus impressus Germar, 1824
One in the Malaise trap.

Stenus ossium Stephens, 1833
One in the Malaise trap.

Stenus pusillus Stephens, 1833
One sieved from moss and grass at the side of The Lake.

Lithocharis ochracea (Gravenhorst, 1802)
One specimen sieved from rotting fungi (*Grifola* sp.) on an old tree stump on The Mound.

Gyrohypnus angustatus Stephens, 1833
Several in rotting goose droppings on The Island and in fungus on The Mound.

Gyrohypnus punctulatus (Paykull, 1789)
Four specimens in a pitfall trap at The Silver Garden.

* *Xantholinus linearis* (Oliver, 1795)
Several specimens sieved from rotting fungus on an old tree stump on The Mound. Buck records it as being common in compost.

Philonthus cognatus Stephens, 1832
Several in the Malaise trap and regularly in pitfall traps in various parts of the Garden.

Philonthus concinnus (Gravenhorst, 1802)
One specimen in a pitfall trap at The Stoneyard.

Philonthus discoideus (Gravenhorst, 1802)
Several in vegetable refuse at The Recycling Centre.

Philonthus varians (Paykull, 1789)
Four specimens in a pitfall trap at The Fire Hole.

Philonthus varius (Gyllenhal, 1810)
Several in a pitfall trap near The Waterfall.

Gabrius pennatus Sharp, 1910
Two specimens taken in a pitfall trap near The Waterfall.

Staphylinus aeneocephalus Degeer, 1774
Occurred regularly in pitfall traps throughout the Garden. The commonest large Staphylinid in the Garden.

Staphylinus ater Gravenhorst, 1802
In pitfall traps, the Malaise trap and in an underground pitfall trap. This species, which occurs more frequently on or near the coast is not uncommon in the Garden.

* *Staphylinus olens* Muller, O. F., 1764. The 'Devil's Coach Horse'
A few specimens in pitfall traps and one in an underground pitfall trap, not common. Buck records it from turves.

Ocypus morsitans Rossi, 1790 (=*Staphylinus compressus*)
One specimen sieved from moss and grass at The Lake.

Quedius curtipennis Bernhauer, 1908
One in an old duck's nest on The Island.

(*Quedius tristis* (Gravenhorst, 1802) (as *Quedius laevicollis*))
Buck records this species from turves.

Quedius mesomelinus Marsham, 1802
One specimen in the Malaise trap.

(*Quedius molochinus* (Gravenhorst, 1806))
Buck records this species from turves.

* *Quedius semiaeneus* (Stephens, 1833)
Not uncommon in vegetable refuse at The Recycling Centre. Buck records it from vegetation, litter and turves.

* *Quedius semiobscurus* (Marsham, 1802)
Several in pitfall traps and at The Recycling Centre. Recorded by Buck from vegetable litter.

Quedius schatzmayri Gridelli, 1922
Several in the Malaise trap on two occasions and a single specimen in a pitfall trap near The Silver Garden.

(*Habrocerus capillaricornis* (Gravenhorst, 1806))
Recorded by Buck from compost, and not seen since. Common in the London Area.

Mycetoporus splendidus (Gravenhorst, 1806)
One male sieved from moss and grass from beside The Lake.

Bolitobius analis (Fabricius, 1787)
One specimen in a pitfall trap near The Stoneyard and another in the Malaise trap.

Sepedophilus marshami (Stephens, 1832)
One in a pitfall trap near The Tea House.

* ? *Tachyporus dispar* (Paykull, 1789)
In pitfall traps, the Malaise trap and grubbing about in moss and at roots in the Garden. Common. Buck records *Tachyporus chrysomelinus*, but the record might refer to *dispar* which has now been separated from *chrysomelinus*.

* *Tachyporus hypnorum* (Fabricius, 1775)
Common in the garden in pitfall traps, the Malaise trap, in moss at the side of The Lake and beating hawthorn blossom. Buck records it from compost and vegetable litter.

(*Tachyporus formosus* Matthews, A. H., 1838)
Recorded by Buck from compost and not seen since. Classed as Nationally Notable (Na).

Tachyporus pusillus Gravenhorst, 1806
Several in pitfall traps and in old goose droppings on The Island.

Tachyporus solutus Erichson, 1839
A single specimen in the Malaise trap.

Tachyporus nitidulus (Fabricius, 1781)
A few specimens in pitfall traps and one in moss at the side of The Lake. Not common in the Garden.

(*Tachyporus pallidus* Sharp, 1871)
Recorded by Buck in an old duck's nest containing broken and addled eggs.

Tachinus signatus Gravenhorst, 1802
One in the Malaise trap. A common species in the London Area and elsewhere but seemingly scarce in the Garden.

Cilea silphoides (Linnaeus, 1767)
Common in rotting vegetation and horse dung at The Recycling Centre.

Cypha longicornis (Paykull, 1800)
A few specimens in various pitfall traps, also by grubbing around in moss and grass near The Lake. Odd specimens in the sweep net and beating tray.

Oligota parva Kraatz, 1862
Common in vegetable refuse and dung at The Recycling Centre. Generally common in the London Area in compost and particularly lawn mowings.

Oligota pumilio Kiesenwetter, 1858
Common at The Recycling Centre in vegetable refuse. Generally common in the London Area in compost heaps.

Leptusa ruficollis (Erichson, 1839)
A single specimen in the Malaise trap. The beetle is usually found under loose bark, often with dry fungus.

Autalia rivularis (Gravenhorst, 1802)
One only in the Malaise trap.

Aloconota gregaria (Erichson, 1839)
Several in pitfall traps in various parts of the Garden and occasionally in the Malaise trap.

Amisha decipiens (Sharp, 1869)
Several at The Recyling Centre in vegetable refuse and horse dung. It is surprising that the more common *A. analis* has not been taken in the Garden.

Dinaraea aequata (Erichson, 1837)
Several in a pitfall trap near The Waterfall and in an old potato buried in the ground nearby.

Plataraea brunnea (Fabricius, 1798)
One taken in a pitfall trap near The Stoneyard.

Atheta amicula (Stephens, 1832)
One specimen in moss and grass at the side of The Lake.

Atheta atramentaria (Gyllenhal, 1810)
Several in an old rotting potato buried in the ground near The Waterfall. In goose droppings on The Main Lawn and on The Island.

* *Atheta crassicornis* (Fabricius, 1792)
Several specimens in goose droppings, Malaise trap, pitfall traps in various parts of the Garden and a single example in an underground pitfall trap. Common. Buck records it from compost.

Atheta coriaria (Kraatz, 1856)
Several in vegetable refuse at The Recycling Centre and in a pitfall trap near The Silver Garden.

* *Atheta fungi* (Gravenhorst, 1806)
A few examples in pitfall traps in various parts of the Garden and grubbing around The Lake in moss and grass. Several in rotting fungus on The Mound. Buck records it from vegetable litter and compost.

(*Atheta hygrotopora* (Kraatz, 1856))
Recorded by Buck from compost. Not the usual habitat for this species which would be more in context in damp areas around The Lake.

Atheta elongatula (Gravenhorst, 1802) v. *balcanica* Brundin, 1944 (*nec* Bernhauer, 1936)
One in the m.v. light trap.

? (*Atheta dadopora* Thomson, C. G., 1867) (as *Atheta arenicola*)
Recorded by Buck from vegetable litter.

? (*Atheta nigra* (Kraatz, 1856) (as *Atheta zosterae*))
Recorded by Buck from compost.

Atheta indubia (Sharp, 1869)
Common in goose droppings on The Main Lawn and on The Island.

* *Atheta laticollis* (Stephens, 1832)
Several specimens in pitfall traps in various parts of the Garden, vegetable refuse and rotting fungus on The Mound. Buck records it from compost.

* *Atheta longicornis* (Gravenhorst, 1802)
Common in goose droppings around The Lake. Buck records it from compost.

Atheta nigricornis (Thomson, C. G., 1852)
Four specimens in the Malaise trap. Usually found in birds' nests in hollow trees.

Atheta nigripes (Thomson, C. G., 1856)
Common in well rotted goose droppings on The Island.

Atheta muscorum (Brisout, 1860)
Common at The Recycling Centre in vegetable refuse and in fungus on The Mound.

* *Atheta sordidula* (Erichson, 1837)
Several in rotting goose droppings on The Island. Recorded by Buck from vegetable litter.

Atheta trinotata (Kraatz, 1856)
Common in vegetable litter at The Recycling Centre.

Atheta triangulum (Kraatz, 1856)
Regularly in pitfall traps in several parts of the Garden, the Malaise trap and in old goose droppings on The Island.

(*Atheta pygmaea* (Gravenhorst, 1802))
Recorded by Buck from compost and not seen since.

(*Atheta subsinuata* (Erichson, 1839))
Buck records this species from compost and it has not been seen since.

Atheta xanthopus (Thomson, C. G., 1856)
A few specimens in a pitfall trap near The Stoneyard and in an underground pitfall trap.

* *Atheta aterrima* (Gravenhorst, 1802)
A few specimens in goose droppings on The Main Lawn. Recorded by Buck from compost.

Atheta clientula (Erichson, 1839)
One in the m.v. light trap.

Nehemitropia sordida (Marsham, 1802)
Common in vegetable refuse at The Recycling Centre, a few specimens in goose droppings on the Island and one in an underground pitfall trap.

Oxypoda brachyptera (Stephens, 1832)
Two examples in a pitfall trap near The Tea House.

Oxypoda exoleta Erichson, 1839
A single specimen of this uncommon beetle was sieved from vegetable refuse at The Recycling Centre by John Owen. Classified as Nationally Notable.

Oxypoda haemorrhoa (Mannerheim, 1830)
Three specimens in a pitfall trap near The Tea House and another in an underground pitfall trap.

Oxypoda opaca (Gravenhorst, 1802)
One only in the Malaise trap.

Oxypoda umbrata (Gyllenhal, 1810)
Several in pitfall traps in various parts of the Garden and one in an underground pitfall trap.

Tinotus morion (Gravenhorst, 1802)
One in the Malaise trap and several in rotting goose droppings on The Island.

Aleochara bipustulata (Linnaeus, 1761)
One in the Malaise trap.

Aleochara intricata Mannerheim, 1831
Several in the Malaise trap.

Aleochara lanuginosa Gravenhorst, 1802
Several in the Malaise trap.

Aleochara sparsa Heer, 1839
One in the Malaise trap. Associated with bird's nests in trees and not uncommon in the London parks.

PSELAPHIDAE

Euplectus infirmus Raffrey, 1910
Several specimens sieved from an old rotten tree stump on The Mound.

LUCANIDAE

Lucanus cervus (Linnaeus, 1758) The Stag Beetle
Several sightings over the past few years according to the gardeners and larvae attributed to this species were found in an old tree stump a few years back. Classified as Nationally Notable (Nb.).

SCARABAEIDAE

Aphodius prodrimus (Brahm, 1790)
A single specimen in a pitfall trap near The Fire Hole.

(*Aphodius rufipes* (Linnaeus, 1758))
Buck records a single specimen from a m.v. trap.

Aphodius sphacelatus (Panzer, 1798)
Four specimens in goose droppings on The Main Lawn.

* *Melolontha melolontha* (Linnaeus, 1758)
One specimen in the Malaise trap. Buck records a single example without any details.

Serica brunnea (Linnaeus, 1758)
Occasionally in the Malaise trap.

BYRRHIDAE

Simplocaria semistriata (Fabricius, 1794)
One in a pitfall trap near The Tea House.

Byrrhus pilula (Linnaeus, 1758)
Occasionally in pitfall traps in several parts of the Garden and several at the edge of The Sand Pit when the cover was removed.

HETEROCERIDAE

Heterocerus fenestratus (Thunberg, 1784)
One example in the Malaise trap. Probably from a colony living somewhere at the side of The Lake where they burrow in soft mud.

BUPRESTIDAE

Agrilus sinuatus (Olivier, 1790)
Emergence holes of this attractive species were discovered in a dead hawthorn on The Island by Richard Jones, who states that the beetle is widespread in the London Area (judging by the number of emergence holes) but adults are very elusive. Classed as Nationally Notable (Nb.).

ELATERIDAE

Agriotes pallidulus (Illiger, 1807)
One in the m.v. light trap. Common in the London Area.

Athous campyloides Newman, 1833
Several in pitfall traps in various parts of the Garden. Occurs regularly in the London Area. Classed as Nationally Notable (Nb.).

(*Athous bicolor* (Goeze, 1777))
Recorded by Buck from specimens taken in a m.v. trap.

Athous haemorrhoidalis (Fabricius, 1801)
Three specimens in the Malaise trap.

Agriotes sputator (Linnaeus, 1758)
Several in pitfall traps in various parts of the Garden.

(*Dalopius marginatus* (Linnaeus, 1758))
Buck records it from m.v. light.

Melanotus erythropus (Gmelin in Linnaeus, 1789)
Two in the m.v. light trap.

THROSCIDAE

Trixagus carinifrons (de Bonvouloir, 1859)
Common in pitfall traps in many parts of the Garden and in the Malaise trap.

Trixagus dermestoides (Linnaeus, 1767)
One only in the Malaise trap (and nearly overlooked).

CANTHARIDAE

Cantharis lateralis Linnaeus, 1758
One in the m.v. light trap.

* *Rhagonycha fulva* (Scopoli, 1763)

A few specimens in the Malaise trap. (A family that we found to be poorly represented in the Garden and one of the few that Buck and Gardner recorded more species than we did.) Buck records it from m.v. light.

(*Rhagonycha femoralis* (Brullè, 1832) (as *Rhagonycha limbata*))

Buck records this species as being swept, with no further details.

(*Rhagonycha testacea* (Linnaeus, 1758))

Buck records this species by sweeping, no further details.

(*Malthodes marginatus* (Latreille, 1806))

Buck records a single specimen at m.v. light.

DERMESTIDAE

Dermestes haemorrhoidalis Kuster, 1852

One specimen in the m.v. light trap. Recorded by Buck from m.v. light in the earlier survey.

Ctesias serra (Fabricius, 1792)

Larvae of this curious beetle found under the bark of plane and hawthorn where it feeds upon dead arthropods caught in spiders' webs, the larvae being seen more often than the adults. Widespread in the London Area, especially in old parks. Classed as Nationally Notable (Nb). Not recorded by Buck, which is surprising, but might be due to the gardeners' likely reluctance to having bark taken from the trees.

Anthrenus verbasci (Linnaeus, 1767)

Regularly swept from flowers and in the Malaise trap.

ANOBIIDAE

Stegobium paniceum (Linnaeus, 1758)

One specimen in the Malaise trap. Occurs in pantries and storehouses where the larvae feed on stored foods particularly cereals. Widespread in London.

MELYRIDAE

Dasytes aeratus Stephens 1830

Several on one occasion in the Malaise trap.

(*Dasytes plumbeus* (Muller, O. F., 1776))

One specimen recorded by Buck from Umbelliferae at The Lakeside, Classified Nationally Notable (Nb.).

NITIDULIDAE

Brachypterus glaber Stephens, 1825

One in a pitfall trap near The Tea House. The species is associated with the common stinging nettle, not a common plant in the Garden.

Meligethes aeneus (Fabricius, 1775)

Very common on flowering plants, probably the commonest beetle in the Garden and apparently a recent arrival as it is not recorded by Buck. Very common in the London Area.

Meligethes nigriscens Stephens, 1830

Four specimens in the Malaise trap.

Epuraea aestiva (Linnaeus, 1758)

Common on hawthorn blossom in particular but also on other flowering plants including daffodils.

RHIZOPHAGIDAE

Rhizophagus parallelocollis (Gyllenhal, 1827)

One specimen taken in an underground pitfall trap. Outside the Garden it is known as 'the graveyard beetle' and is reported on occasions to swarm on graves and corpses buried at some depth in the ground, as well as sap and in rotting fungus.

Rhizophagus perforatus Erichson, 1845
Several records from the Garden including one in an underground pitfall trap, several in a rotting potato buried in the ground and four in a pitfall trap near The Waterfall.

Monotoma picipes Herbst, 1793
Common in vegetable refuse at The Recycling Centre.

CRYPTOPHAGIDAE

Crytophagus scanicus (Linnaeus, 1758)
One in the Malaise trap.

(*Cryptophagus acutangulus* (Gyllenhal, 1827))
Buck records it from an old duck's nest containing addled and broken eggs.

* *Cryptophagus setulosus* Sturm, 1845
Several in pitfall traps in various parts of the Garden and one in an underground pitfall trap. Buck records it from compost.

(*Cryptophagus angustus* Ganglbauer, 1899)
Buck records this species from compost. Classified as Notable.

* *Atomaria atricapilla* Stephens, 1830
One in a pitfall trap at The Silver Garden and a few specimens sieving moss and grass at the side of The Lake. Buck records it as being common in compost.

* *Atomaria fuscata* (Schoenherr, 1808)
A few specimens sieved from moss and grass around The Lake. Buck records it from a similar situation and also in 'humus below rocks'.

(*Atomaria rubella* Heer, 1841 (as *Atomaria bicolor*))
Buck records this species as being common in compost.

Atomaria gutta (Newman, 1834)
Several specimens on one occasion in a pitfall trap near The Silver Garden.

Atomaria lewisi Reitter, 1877
Three specimens sieved from rotting fungi on an old tree stump at The Mound.

Ephistemus globulus (Paykull, 1798)
Recorded by Buck from vegetable litter at The Lakeside.

* *Atomaria testacea* (Stephens, 1830)
Common on several occasions at The Recycling Centre in vegetable refuse. Buck records it from vegetable litter at The Lakeside.

PHALACRIDAE

Olibrus affinis (Sturm, 1807)
Taken many times in the Malaise trap and general sweeping. Once in large numbers by sweeping clover at The Mound.

CERYLONIDAE

Anommatus duodecimstriatus (Muller, P. W. J., 1821)
A single specimen of this uncommon subterranean beetle, often associated with old potatoes buried in the soil, was taken in an underground pitfall trap. Classified as Nationally Notable (Na.).

CORYLOPHIDAE

Sericoderus lateralis (Gyllenhal, 1827)
Several on the soil around a large poplar tree on The Island.

COCCINELLIDAE

Rhyzobius litura (Fabricius, 1787)
In pitfall traps and the Malaise trap. Several on hawthorn blossom and occasionally by grubbing at roots around The Lake.

No Recipient, Fwd: BP beetle

To:
From: Martin Honey <mrh@nhm.ac.uk>
Subject: Fwd: BP beetle
Cc:
Bcc:
Attached:

To: alexwilliams29@hotmail.com
From: Martin Honey <mrh@nhm.ac.uk>
Subject: BP beetle

Hi Alex

Another beetle that has apparently not been recorded previously from Buckingham Palace :

Coccinellidae

Anatis ocellata (Linnaeus, 1758) the Eyed Ladybird

One to light 4.ix.2003

(*Coccidula rufa* (Herbst, 1783))
Recorded by Buck from dry litter.

Clitostethus arcuatus (Rossi, 1794)
A single specimen of this rare little ladybird caught in the Malaise trap. It is associated with ivy. A *Red Data Book* category 1 (Endangered) species.

Stethorus punctillum Weise, 1891
One specimen of this tiny ladybird in the Malaise trap.

Exochomus quadripustulatus (Linnaeus, 1758)
The 'pine ladybird', several on tree trunks and on hawthorn blossom.

Tytthaspis (Micraspis) sedecimpunctata (Linnaeus, 1758)
The 16-spot ladybird was not as common as might be expected; a few examples taken in the sweep net.

* *Adalia bipunctata* (Linnaeus, 1758)
The generally common 2-spot ladybird turned up regularly in the Garden in pitfall traps, the Malaise trap, beating and sweeping. Buck records it as being fairly common when beating and sweeping.

Halyzia sedecimguttata (Linnaeus, 1758)
The 'orange ladybird'. Several hundred noted by Mark Lane overwintering on the underside of a bough.

Adalia decempunctata (Linnaeus, 1758)
The 10-spot ladybird was present in pitfall traps, the Malaise trap, general beating and sweeping. Represented by the type form and several confusing varieties. Surprisingly Buck doesn't record it.

* *Coccinella septempunctata* Linnaeus, 1758
The 7-spot ladybird. Common in pitfall traps, the Malaise trap, beating and sweeping. Often in numbers around the edge of The Lake in moss and grass. Buck took it by beating elm.

* *Propylea quattuordecimpunctata* (Linnaeus, 1758)
Several in the Malaise trap on numerous occasions. Buck took it by sweeping.

Psyllobora (=Thea) vigintiduopunctata (Linnaeus, 1758)
The 22-spot ladybird. Two specimens in the Malaise trap.

Endomychidae

Mycetaea hirta (Marsham, 1802)
A few specimens on two occasions at The Recycling Centre in vegetable refuse.

Lathridiidae

* *Aridius bifasciatus* (Reitter, 1877) (as *Lathridius bifasciatus*)
Several sieved from rotting fungus on The Mound. Four in the Malaise trap and a few in pitfall traps in various parts of the Garden, common at times in vegetable refuse at The Recycling Centre. Buck records it from compost.

* *Aridius nodifer* (Westwood, 1839) (as *Lathridius nodifer*)
Several in pitfall traps, the Malaise trap and occasionally by sweeping. Buck found it common in compost, humus soil, in grass in the cracks of large rocks and by sweeping.

* *Lathridius minutus* (Linnaeus, 1767) (as *Enicmus minutus*)
One specimen in rotting fungus on The Mound. Buck found it common in compost.

(*Enicmus histrio* Joy & Tomlin, 1910)
Recorded by Buck from compost.

Enicmus transversus (Olivier, 1910)
Several in the Malaise trap and occasionally by sieving moss.

* *Cortinicara gibbosa* (Herbst, 1793)
Several in a pitfall trap near The Waterfall and sometimes in the Malaise trap. Buck records it from vegetable litter and compost.

CISIDAE

(*Cis boleti* (Scopoli, 1763))
Recorded by Buck from under elm bark.

MYCETOPHAGIDAE

* *Typhaea stercorea* (Linnaeus, 1758)
Several on two occasions in the Malaise trap. Recorded by Buck from compost.

COLYDIIDAE

Myrmechixenus vaporariorum Guèrin-Méneville, 1843
One example of this uncommon beetle was sieved from vegetable refuse at The Recycling Centre. Recorded from West Kent to Yorkshire in the past and recently from just two vice-counties. A *Red Data Book* category 3 (Rare) species.

Langelandia anophthalma Aubé, 1843
One specimen collected by Richard Jones from soil around the base of a large poplar on The Island. Usually considered to be a rare southern insect, but recent work in Surrey by Prof. John Owen using underground pitfall traps discovered this small, blind subterranean beetle in numbers. The beetle has recently been found in Battersea Park by Richard Jones. A *Red Data Book* category 3 (Rare) species.

TENEBRIONIDAE

(*Blaps mucronata* Latreille, 1804)
Recorded by Buck from the potting shed where it was reputedly sometimes common. Not seen on the present survey or by the gardeners, but hopefully survives unnoticed due to its secretive, nocturnal lifestyle.

Cylindrinotus laevioctostriatus (Goeze, 1777)
One specimen under plane bark on The Island.

Lagria hirta (Linnaeus, 1858)
In pitfall traps and the Malaise trap.

Prionychus ater (Fabricius, 1775)
One specimen in the m.v. light trap.

SALPINGIDAE

(*Rhinosimus planirostris* (Fabricius, 1787))
Recorded by Buck from dry litter.

SCRAPTIIDAE

Anaspis humeralis (Fabricius, 1775)
Common on hawthorn blossom and occasionally by sweeping.

Anaspis lurida Stephens, 1832
A few on hawthorn blossom and in the Malaise trap.

Anaspis pulicaria Costa, A., 1854.
A few on hawthorn blossom and general sweeping.

* *Anaspis regimbarti* Schilsky, 1895
Common on hawthorn blossom and by sweeping. Buck took it in the sweep net.

MORDELLIDAE

Mordellistena neuwaldeggiana (Panzer, 1796)
Three specimens in the Malaise trap. Classed as *RDBK* but not uncommon in the London Area.

OEDEMERIDAE

Oedemera lurida (Marsham, 1802)
One in the Malaise trap.

No Recipient, No Subject

To:
From: Martin Honey <mrh@nhm.ac.uk>
Subject:
Cc:
Bcc:
Attached:

Cerambycidae

Pseudovadonia livida (Fabricius, 1775)
formerly *Leptura livida* F.1775

A common grassland species, larvae in fairy ring mycelia.

One to light 26.vi.2003

ANTHICIDAE

* *Anthicus floralis* (Linnaeus, 1758)
Occasionally in the vegetable refuse at The Recycling Centre. Recorded by Buck from dry litter.

Omanadus formicarius (Goeze, 1777)
One specimen from vegetable litter at The Recycling Centre.

CERAMBYCIDAE

Grammoptera ruficornis (Fabricius, 1781)
A common insect in the Garden in the Malaise trap, on hawthorn blossom and by general sweeping. A recent arrival in the Garden as it was not found on the previous survey.

CHRYSOMELIDAE

Lilioceris lilii (Scopoli, 1763)
Recorded from *Lilium* sp. by Andrew Halstead and by talking to gardeners, common in the London Area.

Phaedon tumidulus (Germar, 1824)
Occasionally in pitfall traps.

Phaedon cochleariae (Fabricius, 1792)
Common by sweeping, adults and larvae.

Plagiodera versicolora (Laicharting, 1781)
Not uncommon in the Garden by sweeping.

Phyllodecta vulgatissima (Linnaeus, 1758)
Occasionally under plane bark.

(*Phyllodecta vitellinae* (Linnaeus, 1758))
Recorded by Buck from willow.

Galerucella calmariensis (Linnaeus, 1767)
On *Lythrum* sp. Andrew Halstead.

Galerucella lineola (Fabricius, 1781)
Several in the Malaise trap.

Phyllotreta atra (Fabricius, 1775)
Several in the Malaise trap.

Phyllotreta nigripes (Fabricius, 1775)
Common on several occasions in the Malaise trap.

Phyllotreta undulata Kutschera, 1860
A few specimens on one occasion in the Malaise trap.

Aphthona euphorbiae (Schrank, 1781)
One of the commonest species in the Garden, in pitfall traps, the Malaise trap, by general grubbing about in moss etc and beating and sweeping.

Longitarsus dorsalis (Fabricius, 1781)
Occurred regularly in the Garden in pitfall traps and in the Malaise trap. I have several records for the London Area, but never seen it elsewhere. It is associated with ragwort (*Senecio*) and classed as Nb.

Longitarsus flavicornis (Stephens, 1831)
Not uncommon in pitfall traps and the Malaise trap. Associated with ragwort.

Longitarsus parvulus (Paykull, 1799)
Not uncommon in pitfall traps, the Malaise trap, beating and sweeping. Once considered rare it has now become common in the south-east although its classification of Na. does not reflect this change.

(*Longitarsus rubiginosus* (Foudras, 1860))
Recorded by Buck from *Convolvulus* by The Lakeside.

Longitarsus succineus (Foudras, 1860)
Once in the Malaise trap, two specimens.

(*Longitarsus ferrugineus* (Foudras, 1860) (as *Longitarsus waterhousei*))
Swept from cultivated mint in The Yard Garden by Eric Gardner. This mint has long gone but Mark Lane took me to a promising patch on The Island which on that occasion produced no *Longitarsus,* but the beetle could still be in the Garden and it is hoped that it will turn up again in the near future. A *Red Data Book* category 1 (Endangered) species.

Crepidodera ferruginea (Scopoli, 1763)
One specimen on thistles, Richard Jones.

Crepidodera transversa (Marsham, 1802)
One specimen on thistles, Richard Jones.

(*Chalcoides plutus* (Lutreille, 1804))
Recorded by Buck from willow.

Chaetocnema hortensis (Fourcroy, 1785)
A common species in the Garden where it occurred in pitfall traps, the Malaise trap and in moss and grass around The Lake. Occasionally in the sweep net.

Chaetocnema concinna (Marsham, 1802)
One specimen in the Malaise trap.

Oulema melanopa (Linnaeus, 1758)
Occasionally in the Malaise trap and once by grubbing at the roots of grass on The Mound.

ATTELABIDAE

Rhynchites aequatus (Linnaeus, 1767)
Common on hawthorn blossom.

BRENTIDAE

Protapion trifolii (Linnaeus, 1768)
One specimen in the Malaise trap.

Protapion fulvipes (Geoffrey, 1785)
In moss and grass around The Lake.

Trichapion simile (Kirby, W., 1811)
Several specimens beaten from birch.

Ischnopterapion loti (Kirby, W., 1808)
One specimen in the Malaise trap.

CURCULIONIDAE

* *Otiorhynchus singularis* (Linnaeus, 1767)
Several in a pitfall trap near The Stoneyard. Recorded by Buck from a dung heap and at the m.v. light trap.

(*Otiorhynchus sulcatus* (Fabricius, 1775))
Recorded by Buck from specimens taken in the mercury vapour light trap.

Phyllobius pyri (Linnaeus, 1758)
Common on hawthorn blossom.

Barypeithes pellucidus (Boheman, 1834)
Two in a pitfall trap near The Waterfall. One in an underground pitfall trap and another in soil around the base of a large poplar on The Island.

Strophosoma melanogrammum (Forster, 1771)
Occasionally in the Malaise trap.

Liophloeus tessulatus (Mueller, 1776)
One in pitfall trap near The Fire Hole.

Sitona lineatus (Linnaeus, 1758)
Common on hawthorn blossom. A few in the Malaise trap and occasionally by grubbing at the roots of moss and grass around The Lake.

Sitona hispidulus (Fabricius, 1777)
One in a pitfall trap near The Tea House.

Magdalis armigera (Fourcroy, 1785)
One in the Malaise trap.

Dorytomus ictor (Herbst, 1795)
Several specimens swept by Richard Jones and John Owen at the base of a black poplar at the southern edge of The Lake. Recorded from several localities in London, mainly on large poplars planted in Parks. Classified Nb.

Ceutorhynchus assimilis (Paykull, 1792)
One specimen sweeping.

Ceutorhynchus erysimi (Fabricius, 1787)
Common on hawthorn blossom.

Parethelcus pollinarius (Forster, 1771)
Several swept from nettles near The Recycling Centre.

Rhinoncus castor (Fabricius, 1792)
Swept from *Polygonum amphibium* at the eastern edge of The Lake.

SCOLYTIDAE

Scolytus scolytus (Fabricius, 1775)
Several in the Malaise trap.

Scolytus multistriatus (Marsham, 1802)
Several in the Malaise trap.

Hylesinus oleiperda (Fabricius, 1792)
Several in the Malaise trap.

Acknowledgements

I would like to thank all those who contributed records, Mark Lane for his help with making arrangements for this survey (and some useful specimens), Norman Heal for his help checking the list, Colin Johnson for naming the Ptilidae and Paul Mabbott for information on the distribution of Carabidae in London.

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Smaller invertebrate orders in Buckingham Palace Garden

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Abstract

A survey of invertebrates was undertaken in Buckingham Palace Garden during the years 1995 to 1997 and comparisons of results made with a survey carried out in the early years of the 1960s. Records of several smaller orders of invertebrates recorded in the garden, yet inadequately represented by number of species to justify separate reporting, are listed and briefly discussed. The list comprises four isopod crustaceans, one species of Thysanura, two species of Ephemeroptera, two species of Odonata, two species of Orthoptera, one dictyopteran, one dermapteran, three Psocoptera, eleven Thysanoptera and five Parasitica. All are common species in the London area.

Introduction

During a survey of invertebrate taxa at Buckingham Palace Garden from 1995 to 1997 is was soon apparent that some invertebrate taxa were too poorly represented to warrant separate publications. Nevertheless, it was considered important that these data should be included in the final report, so that they were not lost altogether. This short paper combines the data for these less well-represented invertebrate orders under a single heading.

Most records emanate from the Malaise trap and species concerned were either identified by the present author or passed to other specialists. Some records, principally of woodlice, originate in the pitfall traps. Other data has been gleaned from the casual observations made by other entomologists undertaking their own studies in the Garden.

Little or no attempt is made to interpret these data, and the intention has been merely to set them on record. Information on these groups gained from the 1960s survey has been included so that the lists are complete.

An annotated list of smaller invertebrate orders recorded in Buckingham Palace Garden

Species found in the earlier survey, but not refound in the present survey, are enclosed in round brackets. Taxa recorded in both surveys are indicated by an asterisk in the left margin. Taxa with neither annotation are recorded for the first time by the 1990s survey.

CRUSTACEA
ISOPODA

Woodlice are a familiar site in most habitats that are not too dry. However, they are most frequent in places that are relatively infrequently disturbed and so are difficult to find in the well-manicured areas of the Garden. Four species, all widespread and common in London, were encountered in the present survey; two of these have been reported in the earlier work. At least one other common species may well be present but has not yet been encountered.

ONISCIDAE

* *Oniscus asellus* L., 1758

This common garden woodlouse was recorded sparingly under debris in shaded parts of the Garden throughout the survey. A few specimens were also noted in the Malaise trap sample for 20.x. – 20. xi. 1995.

PHILOSCIIDAE

Philoscia muscorum (Scopoli, 1763)

Several examples were noted in pitfall traps set amongst vegetation in the Firehole during 1997. The species was, apparently, not encountered during the 1960s survey.

PORCELLIONIDAE

Porcellio scaber Latreille, 1804

Numerically, this was the commonest species of woodlouse during the survey. It was present in many pitfall trap samples and in autumn Malaise trap samples in all three years.

TRICHONISCIDAE

* *Trichoniscus pusillus* Brandt, 1833

Recorded, but without any details, in the 1960s survey. During the 1990s survey it was encountered underneath a timber railway sleeper used as a retaining structure at the edge of a flowerbed near Harrison's Yard.

INSECTA
APTERYGOTA
THYSANURA
LEPISMATIDAE

Known as "bristle-tails", the Thysanura are represented in Britain by seven species in family Machilidae and two in Lepismatidae. The "silver-fish" is their only representative at Buckingham, Palace.

* *Lepisma saccharina* (L., 1758)

The common silverfish was recorded as a single specimen in "a domestic outhouse" in 1962. During the 1995 – 1997 survey, I saw one example near the sink in the Head Gardener's office during 1996.

DIPLURA

No specific searching for these invertebrates, known as the two-pronged bristle-tails, was undertaken during either the 1960s survey or during the present project, and no species are recorded. It is likely that several species are present.

PROTURA

No specific searching for these minute, soil-dwelling invertebrates was undertaken during either the 1960s survey or during the present project, and no species are recorded.

PTERYGOTA
EXOPTERYGOTA
EPHEMEROPTERA

The mayflies are very poorly represented in Buckingham Palace Garden, in keeping with the situation in the central London area generally.

CAENIDAE

(*Caenis horaria* (L., 1758))

Very abundant at light in July [1962] , and also in The Lake, during the 1960s survey. This is a species of larger lakes and rivers, especially where there are good deposits of silt. Its absence during the 1995 – 1997 survey is greatly surprising.

BAETIDAE

* *Cloeon dipterum* (L., 1761)

The 1960s survey notes "nymph in the lake". Several adults and sub-adults were noted in various Malaise trap samples during the 1990s survey at the rate of just one or two per sample. This is a common species in London, where it is known to breed in many garden ponds, apparently preferring waters that are heavily silted (personal observations).

ODONATA

Dragonflies and damselflies are, perhaps unsurprisingly, represented by very few species in central London. At Buckingham Palace garden, the group is represented by just two.

COENAGRIIDAE

* *Ischnura elegans* (van der Linden, 1820)
The earlier survey reports "one male and one female in June [1962] ... has also been taken in the lake". The present survey records adults occasionally in the Malaise trap.

Enallagma cyathigerum (Charpentier, 1840)
An adult male was seen, and photographed, in the Garden by David Carter during June 1999. This is the only record available.

PLECOPTERA

Stoneflies do not appear to be represented at Buckingham Palace Garden in either of the two surveys.

ORTHOPTERA

Grasshoppers and crickets are very poorly represented in the central London area, and areas of land such as Buckingham Palace Garden are relatively isolated. Winged species may occur casually as vagrants, and this may be the nature of the Field Grasshopper (*Chorthippus brunneus*) noted in the 1960s but now, apparently, absent. However, the flightless Speckled Bush-cricket (*Leptophyes punctatissima*) must surely represent a long established colony?

ACRIDIDAE

(*Chorthippus brunneus* (Thunberg, 1815))
Several were noted in long grass by The Lake "in the autumn" during the earlier survey.

TETTIGONIIDAE

* *Leptophyes punctatissima* (Bosc, 1792)
A single female of this wingless species was encountered at the Garden by John Bradley in September 1962; no location within the Garden is given. During the present survey, single adults, both females, were noted in two separate autumn Malaise trap samples.

DICTYOPTERA

Native British cockroaches are more or less confined to our southern shores and the group is represented in London only by those species that live in association with man. These are almost all tropical species that have been artificially introduced to Britain and have adapted to life in warm buildings. They are omnivorous and their presence does not automatically indicate that the premises they occupy are at all dirty. Only one species is recorded at Buckingham Palace, and this has apparently been eradicated.

BLATTELLIDAE

(*Blattella germanica* (L., 1767))
The report of the 1960s survey discretely noted "a few indoors"; none were encountered in the present survey. Although the recent survey was confined to the Garden and did not include heated indoor areas, modern hygiene standards render it most unlikely that cockroaches are to be found inside Buckingham Palace now.

DERMAPTERA

Two species of earwig are present in the built up areas of London, though only the one here reported is at all common.

FORFICULIDAE

* *Forficula auricularia* L., 1758
Recorded as common and found on nearly every visit during the 1960s survey, the situation remains unchanged in the 1995 – 1997 period.

PSOCOPTERA

Also known as "booklice" or "barklice", the Psocoptera are a much-neglected group of insects. No specific searching for them was carried out in the Garden, though three species were noted, one in the present survey and two in the 1960s study.

PSOCOIDEA

PSOCIDAE

(*Amphigerontia bifasciata* (Latreille, in Coquebert, 1799))
One was noted at light in July [1962] in the earlier survey.

PHILOTARSIDAE

(*Elipsocus westwoodi* McLachlan, 1867)
The earlier survey records one male and two females "on bushes" in September [1962].

ECTOPSOCIDAE

Ectopsocus briggsi McLachlan, 1899
Recorded in the Malaise trap on many dates and apparently common here. The surprise is that no other species appear to be represented in the samples.

MALLOPHAGA

No "biting lice" were recorded in either survey, though no specific surveys for these avian ectoparasites were undertaken.

ANOPLURA

No anoplurans were recorded in either survey. Known as "sucking lice", they are ectoparasitic on mammals and no specific survey of them was undertaken.

THYSANOPTERA

Eleven species of thrips were recorded in the earlier survey. I list them here for completeness, without comment, and readers are referred to the original paper for details (Richards 1964). No thrips were listed in the 1995 – 1997 survey.

THRIPIDAE

Chirothrips manicatus Hal.
Chirothrips hamatus Tryb.
Limothrips dentcornis Hal.
Limothrips cerealium Hal.
Aptinothrips rufus (Gmal.)
Odontothrips meridionalis Pr.
Taeniothrips atratus (Hal.)
Taeniothrips vulgatissimus (Hal.)
Thrips fuscipennis Hal.
Thrips major Uzel
Frankliniella intonsa (Tryb.)

ENDOPTERYGOTA

SIPHONAPTERA

No fleas appear to have been recorded in either survey.

HYMENOPTERA

PARASITICA

CYNIPOIDEA

CYNIPIDAE

Andricus kollari (Hartig, 1843)
"marble galls" noted on oak twigs.

Andricus ostreus (Hartig, 1840)
Characteristic galls noted on the midrib of oak leaves

Andricus quercuscalicis (Burgsdorf)
The distinctive "knopper gall"was noted on acorns in the Garden during 1995.

Neuroterus quercusbaccarum (L., 1758)
Leaf galls noted on oak leaves.

CHALCIDOIDEA

APHELINIDAE

Encarsia formosa Gahan, 1924
Identified by Mike Fitton from Malaise trap samples.

STREPSIPTERA

No species of strepsipteran were recorded in either survey. Also known as stylopids, these small insects are parasitic on other insects, notably bees (Aculeata, Apoidea) and plant hoppers (Homoptera).

Acknowledgements

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PLATE M. Buckingham Palace Garden, London. View across The Lake, July 1998.

Photographed © by Mark Lane

Non-lichenised fungi in Buckingham Palace Garden*

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Abstract

Non-lichenised fungi were studied at Buckingham Palace Garden between July 1997 and August 1998. A total of 630 species is recorded of which two are new to science and have been described elsewhere. An earlier survey from 1960 to 1963 recorded only 53 species and of these twelve are not recorded in the 1997 to 1998 results. The list of recorded species is presented and discussed.

Recording methods

The fungal records are based largely on 36 visits by the present author from July 1997 to August 1998, once a week during much of the time, once a fortnight when conditions were less productive. These are supplemented by many records from Peter Holland, who has recorded mainly microfungi and myxomycetes, a few from David Hawksworth made while recording lichens, and a few from single visits by Bruce Ing and Brian Spooner.

Many fungi are too small to have much chance of being observed directly in the field. To ensure that some at least of these were recorded, suitable substrates were often collected 'on spec' and examined at leisure under a dissecting microscope. Substrates well known to support a wide range of fungal species were then 'cultured', i.e. kept in moist conditions in normal light at room temperature for a number of days or weeks, and examined at intervals. This is a standard technique for recording myxomycetes on bark or for observing the succession of fungi that appear on dung, but it is also effective in revealing fungi on many other substrates. It was used on hazel nuts, acorn cups, beech cupules etc. and on fallen leaves. Leaves of *Laurus nobilis* and *Quercus ilex* are known to be rich sources of hyphomycete species in particular (Kirk 1981), and duly proved very productive. Several groups of fungi requiring specialised identification techniques were not studied at all, notably fungi parasitic on insects and most hyaline hyphomycetes.

Collections, when in good condition, of all the less common or more critical species have been deposited in Kew Herbarium (K), and in a few instances also in the herbarium of CABI Biosciencies (IMI).

Numbers of Species

A total of 630 species has been recorded, including at least two new to science. Several others have not been matched at Kew and have been filed as unnamed species pending revision of the genera concerned.

That so many have been recorded reflects the personal good fortune of the author in having time to devote to the project and in being given generous access to the garden. Another crucial factor has been the valuable help supplied by many experts. Even so, the present total could surely be at least doubled given more years of recording and a rather improbable measure of further expert back-up.

Around 12,000 species have been recorded in Britain and more remain to be distinguished. Given the range of habitats in the garden and the mobility of most fungal spores, the current figure of not much over 5 per cent of known British species is evidently still low. The ease with which further species continue to be found on each successive visit reinforces this conclusion. But just how far the total could rise given more years of recording must remain a matter for idle speculation. No site anywhere in the world has been anything like exhaustively monitored for fungi. There are, therefore, no statistical models by which to extrapolate from limited recording to an estimate of the true total of species present at any given time.

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* Unfortunately, the author has been unable to prepare a final manuscript of his paper of the non-lichenised fungi at Buckingham Palace Garden. It has been necessary, therefore, in order to achieve completeness in the overall report, to edit and print Dr Henrici's draft paper, which he prepared at the end of 1997. This paper has not, therefore, been subjected to peer-review.

The Garden as a Site for Fungi

The garden is far from exclusively formal. The formal lawns and beds blend into other areas such as parts of The Mound and the Island which are left semi-wild. In places the grass is allowed to grow long and is cut once a year almost as a hay meadow. The Lake has a long perimeter of marsh plants under a similar regime. Most native British tree species are present in small numbers, together with innumerable exotics. The happy result is a far richer diversity of habitats than might be imagined and a corresponding richness in the fungal population.

For the last eight years the Recycling Centre has been in operation, the compost applied to the beds being largely derived from the Garden itself, supplemented only by horse dung and stable straw from the adjacent Royal Mews. Fungi that enjoy this regime sometimes build up in large numbers on mulched beds. Fungicides are sparingly applied, though war is waged on Honey Fungus (*Armillaria mellea*). New plants are constantly being imported into the garden, some unintentionally carrying further fungi with them.

To counterbalance the above pluses there is one large minus for fungi, the shortage of rotten wood or woodland litter. Fallen trunks and branches are speedily chopped up and removed. Records of lignicolous fungi have had to come from close monitoring of the few rotting tree stumps in the garden. The main sources of leaf litter are *Ilex, Rhododendron, Camellia*, and overwhelmingly in late autumn the hundred or so mature *Platanus*. But this is all promptly swept up and recycled, so the floor of the shadier beds tends to be rather unproductive mycologically.

The garden is fairly acid, so strictly calcicole species are in general absent (but see below for some unexpected *Lepiota* species). It is also fairly dry, but gets well watered in parts, producing unexpected fungal flushes at otherwise unproductive times. Recent record warm years combined with the additional warming from its central London situation make it a prime site to expect new British records of southern thermophyllic species, but none have so far appeared.

The Survey in Perspective

In the 1960-63 Palace survey the fungi were scarcely recorded at all. The list contained only 53 species, some named only to genus. Twelve of these have not been seen again, three agarics, three ascomycetes and six mitosporic fungi, discussed in the appropriate sections below. There will undoubtedly have been changes in the fungal population since 1963, reflecting changes in the garden as a whole. Certain hosts are gone, such as the mature elms, and tulips which were formerly planted out by the thousand. Many more have come, notably a wider range of conifers. There have also been changes in the country at large. A few 'worldwide weed' fungi that were unknown or scarcely known here in 1963 have become common in Britain.

There is a lack of comparable studies from which to assess the importance of the Garden as a fungal habitat. Little has been done in the London parks apart from occasional autumn forays recording the larger toadstools. A partial exception is Holland Park, where the present author recorded fungi intermittently over the period 1980 to 1996 while living in the area. His unpublished list, including records by other observers, is held by the Holland Park Ecology Officer. It included 199 'Agarics & Boletes', 11 Gasteromycetes and 69 'Other Basidiomycetes', figures very comparable to those currently recorded from the Palace Garden. However, these totals were only reached over sixteen years of recording. Too few records were made in other fungal groups to provide comparative data.

Comparison may also be made with the Royal Botanic Garden, Kew; more rural, nearly eight times the size, with an even wider range of host plants, and a century or so of fungal records. Massee (1906) recorded 1300 species. A revised list of just the agarics and boleti was prepared by Pegler (1966) who listed 570 species, though considering many of the older records doubtful. The doubtfuls are likely to have been at least offset by other good records in the last thirty years, giving an approximate factor of three between Kew and the Palace in the numbers of agarics and boletes reported. This may be due in about equal measure to greater habitat diversity and greater recording effort at Kew.

Another London site the author has surveyed in detail is Perivale Wood, Ealing, an oak/bluebell wood with adjacent unimproved pasture. There some 940 species have been recorded over ten years including 290 agarics and boleti. It is a site of comparable size, containing far fewer higher plant species, but 'wild' and well supplied with dead wood and litter. It is now getting difficult to record more species there in any quantity, whereas at the Palace Garden it is still merely a matter of spending more time.

As a final point of comparison Esher Common, Surrey is very much larger with a more diverse range of habitats. It is one of the two most intensively surveyed areas in the country for fungi and has a list built up over many years currently standing at 2,800 species (Brian Spooner, unpublished ms.).

All these pointers suggest the Palace list still has a long way to go. Ideally every potential fungal substrate needs examining at every time of year over several years. That is the easy bit. It then needs experts to offer verdicts on the fungi so found, many of which in the more obscure groups are likely to be undescribed. But it is already clear from the current survey that the Palace Garden supplies an undisturbed haven for many fungi that are rarely recorded in the London area.

Notes on the various groups of fungi

The fungi are here considered to comprise (in a widely used formulation) 'all organisms studied by mycologists'. They are a very diverse assemblage, currently occupying all of one Kingdom and small parts of two others (Dictionary of the Fungi, 1995). They are treated below and in the species lists in 10 numbered groups related as follows:

- Kingdom Fungi
  - Phylum Basidiomycota
    - Class Basidiomycetes
      - c.20 Orders, here treated in three groups:
        - 1. Agarics & Boletes
        - 2. Gasteromycetes
        - 3. Other Basidiomycetes (Aphyllophorales + Heterobasidiomycetes)
    - Class Teliomycetes: 4. Rusts
    - Class Ustomycetes: 5. Smuts
  - Phylum Ascomycota
    - No Classes currently defined, here treated in three groups:
      - 6. Powdery Mildews
      - - Lichenised Ascomycetes (not included in the present work)
      - 7. All Other Ascomycetes ('Discomycetes' + 'Pyrenomycetes')
  - Phylum Zygomycota:
    - 8. Zygomycetes
  - Mitosporic Fungi (= Fungi Imperfecti)
    - 9. Coelomycetes + Hyphomycetes
- Kingdom Chromista p.p.
  - Phylum Oomycota:
    - 10. Oomycetes
- Kingdom Protozoa p.p.
  - Phylum Myxomycota: Myxomycetes (not included in the present work)

1. **Agarics & Boletes** (200 species)

Several habitats call for discussion:

The famous lawns are not species-rich, but are far from devoid of fungi. The Main Lawn is largely free of fairy rings, but these and their causal agent *Marasmius oreades* are plentiful over much of the remaining grass, as is the 'hay-cap' *Panaeolus foenisecii* throughout the summer. In late autumn, in common with other old and not over-fertilised lawns in the London area, very large troops of three *Mycena* species can occur in a favourable year, *M. aetites, M. olivaceomarginata* and *M. flavoalba*, together with other lawn species such as *Hemimycena mairei, Galerina laevis* and *Tubaria conspersa.*

Many beds periodically receive a heavy mulch via the recycling system. This regime seems to favour above all the wood blewit, *Lepista nuda*, present in enormous numbers in all the shadier beds in late autumn but recorded in literally every month of the year. Fructifications were very variable in shape, size and colour, leaving the demarcation from *L. sordida* far from clear. *Coprinus flocculosus, Conocybe rickenii, C. siennophyla* and *Panaeolus subbalteatus* are other species regularly occurring in this habitat. A few beds have the spectacular *Stropharia aurantiaca* that has become common in south-east England in recent years with the spread of bark mulches. But pride of place must go to *Panaeolus atrobalteatus*, new to science (see Pegler, 1998), which appeared in spectacular numbers (around 3,000?) in just one bed under holly in November 1997, where it was initially observed by Mark Lane. This was at first thought to be a dark grey colour variant of *P. subbalteatus*, but was found to have much smaller spores and to fit nothing in the world literature on this genus. The mystery is where it came from and why it fruited so prolifically in just one bed when others shared the same aspect and had received the same composting regime. It is too conspicuous a species to have been overlooked until now if it had long been present in western Europe. Further appearances are awaited with interest.

The lakeside has produced a number of interesting and little recorded species of *Inocybe* and *Cortinarius mycorrhizal* with *Populus* or *Salix*. In particular a puzzling *Inocybe* in the *I. dulcamara* group is common here. If it has been previously recorded in Britain it is likely to have been as *I. perbrevis*, but the correct interpretation of this name is open to doubt.

In damp summers the bases of long grass clumps (especially *Holcus*) provide an interesting habitat that has evidently been insufficiently studied in Britain. *Melanotus phillipsii* is the most characteristic species of this community and was found in abundance. More interesting was *Entoloma albotomentosum*, minute, initially white but pink when the spores ripen, growing right at the base of grass clumps where it will never be found without deliberate exploration. Its habits are so retiring that it was only discovered and described as new to science from Austria in 1989. A record on 30 June 1998 was the second in Britain, the first being nine months earlier at Kindrogan, Perthshire. However once the habitat was known and other mycologists alerted it was promptly discovered to be widespread in Kew Gardens and was also found without difficulty at Runnymede and in Windsor Great Park. It seems likely to be common over much of Britain, a good example of how much is still to be learnt about Britain's fungi.

Several beds briefly displayed a surprising array of notably calcicole species of *Lepiotaceae*, eventually traced to an exception to the general recycling regime. Application of a proprietary compost to certain beds, billed as a renewable resource derived from underground Pennine aquifers, produced a remarkable flush of uncommon species, including *Lepiota cortinarius, L.fuscovinacea, L. hetieri* and *L. setulosa.* These are not expected to be seen again as the soil is, in general, too acid.

Surprisingly a small area of grassy slope just north of the lake produced a few of the characteristic fungi of unimproved grasslands, with two *Hygrocybe* species, a *Dermoloma* and a *Clavaria* all found nowhere else in the Garden. It would be nice to think that these represent survivors of the marshy meadow community that must have existed before the Palace was built or the Garden enclosed.

On the debit side, the main mycorrhizal genera are poorly represented. *Boletales, Russulales* and *Amanita* are represented by few species in small numbers. For instance the following, which are among the most commonly recorded of all British fungi, have not been found: *Boletus badius, Russula ochroleuca, Lactarius quietus, Amanita fulva* and *A.citrina*. Among other very common woodland fungi *Collybia confluens, C. maculata* and *C. peronata* also appear to be absent, though *C. butyracea* and *C. dryophila* are both quite plentiful on The Mound. Maybe the others cannot stand the litter clearing regime. Even *Mycena speirea* has not been seen.

Among many genera to cause identification problems the most awkward has probably been *Clitocybe*. Quite a few species are present at various times of year and in various habitats, but seldom keying out with conviction among the conflicting treatments in the literature. *Agaricus* and *Hebeloma* leave similar feelings of uncertainty, though there is no doubt that among several *Agaricus* species present the commonest are *A. xanthoderma* and *A. bisporus*.

Three species on the 1963 list have not been re-recorded. The most notable is the well known 'Magic Mushroom' *Psilocybe semilanceolata*, recorded on the lawn as recently as 1979, but not since. The other two are *Macrolepiota rhacodes*, the 'Wood Parasol', common in many Inner London wooded areas and rather surprisingly not found, and *Cystoderma amianthinum* whose presence in the earlier survey was somewhat unexpected.

2. Gasteromycetes (11 species)

A traditional grouping, but with affinities in various directions and no longer considered to form a single class of fungi.

The giant puffball, *Calvatia gigantea*, already recorded in 1963, occurs in numbers in some beds and especially the Firehole. One of the bird's nest fungi, *Cyathus olla*, flourishes with the composting regime and often appears on beds in large numbers, but the others seem absent. Another notable absentee is the stinkhorn, *Phallus impudicus*. One unusual species was found, a small (1.5cm) but far from edible 'truffle', *Melanogaster ambiguus*, the so-called 'stinking slime truffle', sometimes found in domestic timber when 'a single specimen in a room is so strong as to make it scarcely habitable' (Berkeley, quoted in Pegler et al. 1993). This one was at the soil surface on The Mound and did not smell too bad when collected but later developed a powerful and complex aroma of rotting fruit or vegetables.

3. Other Basidiomycetes (101 species)

Here are included both the 'Aphyllophorales' (club fungi, polypores, corticioids etc.) and the 'Heterobasidiomycetes' (jelly fungi). Neither of these groups is now recognised as a natural unit. Species on the Palace Garden list are currently distributed among some 20 orders.

These are largely lignicolous fungi so would not be expected to be particularly well represented. But although there is not much rotten wood present, what is there is fairly varied, so a fair range of records have nevertheless been made. Two rather uncommon species are worthy of note: *Auriculariopsis ampla* superficially resembles a small pale *Auricularia*; it grew on *Populus* twigs by The Lake and is not known from more than around ten sites in Britain. *Perenniporia fraxinea* as its name suggests is a perennial polypore, but is not confined to *Fraxinus*. It has evidently been growing for some years at the base of one of the Plane trees. It is already known in this habitat in the London area, but is not common. It causes a white root and butt rot, but the tree is likely to survive for many years yet.

Corticioid fungi are not yet well recorded in Britain, good literature having only recently become available. So inevitably a few of the finds in this group give the impression of being rarities, though this may not in fact be the case. *Cristinia coprophila* however is probably genuinely rare. It was described from a manured bed in Kew in 1916 and had only been found in Britain once since (Perivale Wood, Middlesex 1994) before being recorded here in July 1997 under a sheet of chipboard. It is also scarcely known outside Britain. *Ceratobasidium calosporum* was previously known only from the type collection from Iowa until recorded in Britain by Peter Roberts in 1991. He has since recorded it from several sites in southern England, but it is still unknown elsewhere in Europe. The Palace collection was on the bark of a fallen *Sorbus*, probably *S. aucuparia.*

Among notable absentees it may be significant that no *Typhula* species have been found on leaf litter.

4. **Rusts** (24 species)

These are probably somewhat under-recorded in comparison with most groups. They need a collector with a good knowledge of where and when to expect them. Nothing very rare or remarkable has been found except that the survey coincided with the rapid spread in England of the 'new' rust on daisies, *Puccinia distincta.* This rust is a native of Australia, which from being unknown in Britain, spread during 1997 and 1998 to being common on *Bellis perennis* throughout most of England, its aecidia producing conspicuous yellow patches on the leaves (see Weber et al. 1998). It was first recorded at the Palace in September 1997 a few weeks after it had already become well known at Kew, and is now widespread on the lawns.

5. **Smuts** (2 species)

Not a large group, but 46 species have been recorded from south-east England (Dennis, 1995), so they appear to be somewhat under-recorded. Several potential hosts are present, but the two that can normally be almost guaranteed to carry smuts (*Arrhenatherum elatium* and *Silene dioica*) are each only present in small numbers.

6. **Powdery Mildews** (45 species)

These comprise just one of 14 orders of Ascomycota recorded from the Garden, but they are so distinct from the rest and so well represented that they are treated separately. As gardeners will know, mildews are a fact of life, and the richer the garden, the richer will be the mildews. With its wide range of labelled plants the Palace provides an ideal place to make interesting mildew records. Ing (1990) lists 99 species as British, most confined to a particular genus or family of plants. Nearly half of these have been recorded, a far higher proportion of the British total than in any other group of fungi. And undoubtedly more remain to be found, as suitable hosts are present for many of the rest.

None of the mildews found are new to Britain, but several, indicated in the list, occurred on new hosts (for Britain). Most of these are unremarkable, being merely found on garden relatives of their normal hosts (eg. the common mildew on *Ranunculus* spp. was found also on *Cimicifuga*). But the common Cat's-ear (*Hypochaeris radicata*) seems not to have been noted before in Britain among the many *Asteraceae* that are hosts to *Erysiphe cichoracearum*. The mildew on the London Plane, *Microsphaera platani*, is a recent arrival in Britain, after spreading steadily westwards across Europe. It is not expected to do serious damage to the trees. The first British record was in 1990 by B. Ing, who is also responsible for the Palace record.

The traditional division into 'Discomycetes' and 'Pyrenomycetes' is not followed in the species list, as neither are natural units. All are merely Ascomycetes, within which 14 non-lichenised orders are represented in the Garden.

Discomycetes records have been rather few and the group is remarkable chiefly for absences. The annual cut back of long vegetation round the lake removes the dead herbaceous stems that might otherwise be host to many small species. The lack of rotting wood has meant that several very common species including *Ascocoryne sarcoides, Bisporella citrina, Scutellinia scutellata* and even *Lachnum virgineum* have all gone unrecorded. However a small red-brown *Peziza* species found at the base of grass clumps in June 1998 is certainly new to Britain and possibly undescribed according to B. M. Spooner; more research is needed to establish its status.

Several pyrenomycetes normally considered rare have been found, though as these are all fairly small and inconspicuous they may merely be under-recorded elsewhere. *Kernia nitida, Podospora perplexans* and *Zopfiella erostrata* on horse dung are rarely recorded. *Cephalotheca sulfurea* is distinctive and probably genuinely rare. It has occurred throughout the year under some pieces of worked conifer wood of unknown origin. *Trematosphaeria tripartita*, on a fallen *Sorbus* branch, is only the second British collection of a recently described species; the first, from Skye, was also on *Sorbus*.

The most interesting pyrenomycetes have been two distinctive species of *Melanospora. M. longisetosa* was described in 1982 from a single collection on an elm stump at Kew and known since only from *Laurus* leaves in Dorset. At the Palace it occurs on a wide range of different hosts including *Laurus*, but also *Araucaria* (Monkey Puzzle) leaves, on which it was particularly abundant. Possibly these are its natural home as it was subsequently found again on *Araucaria* leaves from Kew, in each case only after keeping them damp for two weeks or more. The second species also occurred on fallen leaves of *Laurus*, but additionally on *Camellia* and *Rhododendron*, and appears to be undescribed.

The absence of rotting wood is reflected in the dearth of *Hypoxylon* species. Only *H. rubiginosum* has been recorded. There are several beech trees so *Diatrype disciformis* is probably not really absent, but their litter is so efficiently swept up that the fungus has not yet been recorded.

Three species from the 1963 survey have not recurred. Two of these, *Mitrophora semilibera* and *Verpa conica*, are relatives of the morels, not very common, more usually on calcareous soils, and altogether rather unexpected when D. A. Reid found one of each on 1 May 1963. There is also a collection at Kew of an actual morel, *Morchella conica* (which would now be called *M. elata*) collected by Fred Nutbeam (then Head Gardener) in 1967 'amongst moss on top of old wall, B. P .Gate', a location that cannot now be traced. These have all been searched for, but it is no great surprise they have not been found again. The third species from 1963 is the inconspicuous *Nectria aguifolii*, probably still present as its host *Ilex* is abundant.

8. Zygomycetes (6 species)

Around 100 species are known in south-east England (Dennis, 1995), mostly moulds in the order *Mucorales*. But no serious effort has been made to record this group. Only chance finds have been made of a few of the more distinctive species. The *Zygomycota* also include a second rather obscure class, the *Trichomycetes*. These are parasites or commensals in the gut of arthropods, e.g. in the larvae of aquatic *Diptera* and have, not surprisingly, gone unrecorded in this survey.

9. Coelomycetes & Hyphomycetes (132 species)

These are often referred to as 'Fungi Imperfecti' and more recently as Mitosporic Fungi. They are asexual, some having a known sexual state in the Ascomycetes, others probably having one that has yet to be identified, yet others probably without the capacity to form a sexual state and reproducing only by conidia. Coelomycetes form their conidia within a cavity surrounded by fungal tissue, hyphomycetes form them in the open, but there are intermediates and the significance of this distinction has been over-emphasised in the past.

Most coelomycetes are rather featureless and difficult to identify, just as larvae are in general less readily identifiable than perfect insects. Many have not been attempted. Two recorded as new to Britain in the 1963 survey have not been refound, nor has one on elm twigs. Three of the 1963 hyphomycetes have not been refound either. Two are probably still present, but the third, *Botrytis tulipae* = Tulip Fire Fungus, is likely to have departed from the garden together with the major plantings of tulips. Many hyaline hyphomycetes, including well-known genera such as *Penicillium, Fusarium, Verticillium* etc. in general need to be grown in pure culture for a reliable identification. This is outside the scope of the present survey.

The dematiaceous (= non-hyaline) hyphomycetes are in general easier. Quite a number have been recorded, often by damping suitable substrates and keeping them under observation. Several species previously reported as specific to the leaves of *Quercus ilex* or *Laurus nobilis* were also found on other tough fallen leaves such as those of *Rhododendron* and *Camellia*. *Sporidesmium dennisii*, common here on *Quercus ilex* leaves on The Mound, was previously known only from its type site at Wakehurst Place (East Sussex) and from Esher Common (Surrey). Several species await determination, some of which may be undescribed. This is a group in which it is much easier to find a new species than it is to find an expert with the time to verify that it is new and to describe and publish it.

10. Oomycetes (2 species)

These are no more fungi than are the myxomycetes. They are now placed in a different kingdom, *Chromista*, together with a variety of obscure mainly unicellular organisms, but are listed here on the grounds of tradition and convenience. The best known Oomycetes are the *Peronosporales*. These include the downy mildews and also the 'white' or 'blister' rusts, plant pathogens in the genus *Albugo*, two of which have been recorded. Downy mildews must occur in the garden, but they are very inconspicuous and seem to need a trained eye to detect them. Other Oomycetes likely to occur include members of the genus *Pythium* causing damping off in seedlings and a variety of root rots. Some of the *Saprolegniales* or 'water moulds' could also be present infecting fish in the lake.

A annotated list of the non-lichenised fungi recorded in Buckingham Palace Garden

Sources	(usually only of first record)
1963	recorded on the 1963 published list
BI	recorded by Bruce Ing while collecting bark myxomycetes 16.1.97
DIH	recorded by David Hawksworth
PCH	recorded by Peter Holland
+	(suffixed to any of the above) means seen personally, 7.7.97 onwards
m.n	day.month (in 1997) of first personal record

A letter 'K' denotes that material (not necessarily of the first collection) has been deposited in the Kew herbarium or will eventually be deposited there. Similarly IMI denotes material at the International Mycological Institute.

Two further phyla studied by mycologists, Qomycota and Myxomycota, are also covered here, though no longer considered part of the kingdom Fungi.

BASIDIOMYCOTA

AGARICALES (in conventional order of families)

Hygrophoraceae

Hygrocybe conica	PCH+ as *H. nigrescens*
virginea	24.11 K

Tricholomataceae

Armillaria lutea s.l.	20.10 = *A. mellea* of 1963 list p.p.
Armillaria mellea s.s.	6.10 = *A. mellea* of 1963 list p.p.
Baeospora myosura	10.11 on *Cedrus deodarus* K
Calocybe carnea	7.7
Calyptella capula	PCH+
Clitocybe agrestis	7.7 = *C. angustissima* = *C. graminicola* K
cf. *amarescens*	24.11 ?= =*C. nitrophila* K
dicolor	24.11
nebularis	PCH as *lepista* n.
rivulosa	20.10 K
vibecina	17.11
Collybia cirrhata	20.10
dryophila	4.8
erythropus	20.10
obscura s.auct	24.11 K
Dermoloma josserandii v. *phaeopodium*	24.11 = *D. phaeopodium* Orton 1980 K
Flammulina velutipes	24.11
Hemimycena mairei	15.9 PCH det. AH K
Laccaria laccata	PCH+
Lepista nuda	1963+
saeva	10.11 K
sordida	17.11 K
Lyophyllum decastes	21.7
Marasmiellus ramealis	7.7 (needs confirmation, might have been next)
vaillantii	20.8 = *Marasmius calopus*
Marasmius curryi	4.8 = *M. graminum*
oreades	PCH+
rotula	PCH+
Melanoleuca arcuata	10.11 = *M. melaleuca* s.auct. p.p K
polioleuca	20.10 = *M. melaleuca* s. auct. p.p. K
strictipes	9.9 K
Mycena adscendens	17.11
aetites	20.10 K
clavularis	DLH det. E.E. Emmett
filopes	17.11 K
flavescens	20.10 K
flavoalba	PCH+
galopus v. nigra	17.11 K
leptocephala	20.10 K
galericulata	PCH+
olivaceomarginata	20.10 K
polyadelpha	17.11
sanguinolenta	28.11
stylobates	4.8
vitilis	10.11
Resupinatus applicatus	28.11 inc. *R. trichotis* K
Rickenella fibula	4.8
swartzii	24.11
Tricholoma scalpturatum	10.11 = *T. argyraceum* s.auct.

Entolomataceae

Clitopilus hobsonii	20.10
Clitopilus prunulus	PCH+
Entoloma farinolens	9.9 cf this (one old specmen only)
hebes	27.10 K
sericeum	17.11 K

Pluteaceae

Pluteus cervinus	1963+
podospileus	7.7 K
Volvariella speciosa	1963+

Amanitaceae

Amanita muscaria	PCH+
rubescens	7.7
spissa	7.7 = *A. excelsa*

Agaricaceae

Agaricus bisporus	1963+
Agaricus campestris	PCH+
cf. *comtulus*	20.10 K
cf. *niveolutescens*	6.10
silvaticus	7.7
variegans	20.10 K
xanthoderma	7.7
Cystoderma amianthinum	1963
Lepiota cortinarius	20.10 K
cristata	PCH+
+ cf. var. *felinoides*	27.10 (not worth separating?) K
fuscovinacea	20.10 K
hetieri	20.10 K
josserandii	15.8 ? = *L. subincarnata* K
cf. *kuehneri*	17.11 K
Leucoagaricus cinerascens	27.10 K
leucothites	PCH+
subcretaceus	17.11 K
sp. indet.	6.10 K
Leucocoprinus birnbaumii	4.8 in Greenhouse No. 1
Macrolepiota rhacodes	1963
Melanophyllum haematospermum	20.10 = *M. echinatum* K

Coprinaceae

Coprinus atramentarius	1963
cinereus	27.10 K
disseminatus	7.7
flocculosus	4.8 K
friesii	4.8
cf. *heterosetulosus*	15.8 K
leiocephalus	15.8
macrocephalus	6.10 K
marculentus	15.8 = *C. hexagonosporus* K
micaceus	PCH+
patouillardii	27.8 K
plicatilis	1963+
Lacrymaria velutina	7.7
Psathyrella atrolaminata	17.11 K
microrrhiza	17.11 K
gracilis	19.9 K
multipedata	PCH
piluliformis	24.11 = *Ps. hydrophila* K

Bolbitiaceae

Bolbitius vitellinus	PCH
Conocybe arrhenii	28.11 K
lactea	15.8 K

cf. *kuehneriana*	15.8
rickenii	19.9 K
siennophylla	7.7 K
sordida	20.10 K
vestita	10.11 K

Strophariaceae

Hypholoma fasciculare	PCH+
Melanotus phillipsii	4.8 (inc. rec. on bluebell stem) K
Panaeolus foenisecii	7.7
subbalteatus	20.8 (inc. rec. as *P.* cf. *fimicola* 7.7) K
sp. nov. ??	*24.11 near P. subbalteatus,* spores much smaller
Pholiota conissans	20.10 K
cf. *limonella*	24.11 = *Ph. adiposa* s.auct. K.
squarrosa	PCH+
Psilocybe semilanceata	1963 still present in 1979 (Mark Lane)
Stropharia aurantiaca	10.11
caerulea	20.10 = *S. cyanea*
inuncta	20.10 K
semiglobata	PCH

Crepidotaceae

Tubaria autochthona	20.10
conspersa	20.10 K
furfuracea	1963+
cf. *pallidospora*	6.10K

Cortinariaceae

Cortinarius cohabitans	10.11 = *c. saturninus* v. *bresadolae* det. G. Kibby K
hemitrichus	10.11
parvannulatus	17.7 = *C. cedriolens,* det. G. Kibby K
sertipes	6.10 K
cf. *violilamellatus*	10.11 det. G. Kibby K
Galerina clavata	20.10 K
hypnorum	PCH+
laevis	20.10 = *G. graminea* K
Gymnopilus penetrans	24.11 K
Hebeloma bruchetii	10.11 = *H. repandum* s. Bruchet det. Kibby K
crustuliniforme	PCH+
gigaspermum	20.10 K
leucosarx	10.11 det. G. Kibby K
mesophaeum	10.11 K
pusillum	19.9 K
vaccinum	20.10 K
Inocybe curvipes	7.7 = *I. lanuginella* K
cf. *flocculosa*	9.9 one sepcimen only
geophylla	7.7
malenconii	7.7 near *I. dulcamara* – new to Britain? K
pusio	15.9 PCH det. AH K
squamata	20.10 K

BOLETALES

Boletus edulis	PCH
Chalciporus piperatus	10.11
Paxillus involutus	7.7
Xerocomus chrysenteron	PCH+ as *Boletis*

RUSSULALES

Lactarius subdulcis	7.7
turpis	10.11
Russula amoenolens	7.7 = *r. sororia* s.auct. Brit.
atropurpurea	10.11
cyanoxantha	7.7
foetens	7.7
parazurea	7.7

'APHYLLOPHORALES' (Bracket fungi etc.)

Abortiporus biennis	20.10
Athelia arachnoidea	DLH+
Auriculariopsis ampla	18.8 PCH det. AH. *Populus* twigs K
Bjerkandera adusta	1963+
fumosa	9.9 *sorbus* × *latifolia* stump
Botryobasidium aureum	DLH *Haplotrichum* anamorph state only, IMI
Brevicellicium olivascens	6.10
Byssomerulius corium	PCH+
Ceriporia viridans	28.11
Ceriporiopsis gilvescens	PCH det. P. J. Roberts K
Chondrostereum purpureum	1963+ as *Stereum* p., eg on *Salix* stump
Clavaria acuta	24.11 K
argillacea	28.11 K
Clavulina cristata	PCH+ 18.8
Clavulinopsis helvola	27.10
laeticolor	6.10 = *c. pulchra* K
Coniophora puteana	1963+ in 1963 as 'forma laxa')not worth sep.)
Cristinia coprophila	221.7 3rd Brit. record, on chipboard K
Crustomyces expallens	28.11 K
Cylindrobasidium evolvens	1963+ as *Corticium* laeve
Daedaleopsis confragosa	PCH+
Gloiothele lactescens	7.7
Ganoderma adspersum	1963+ as *g. applanatum* (not then distinguished)
Henningsomyces candidus	7.7 K
Hyphoderma praetermissum	1963+ as *Gloeocystidium tenue*
puberum	10.11 *Sorbus* × *latifolia* stump K
setigerum	7.7
Hyphodontia sambuci	21.7
Hypochnicium bombycinum	17.11 *Betula* stump
lundellii	20.8 *Populus* roots, 3rd Brit. rec. K
punctulatum	9.9 *Sorbus* × *latifolia* stump
Lentinus lepideus	27.8 from sleepers edging a bed K
Meripilus giganteus	PCH+
Merismodes fasciculatus	24.11 fallen *Salix* twig K
Peniophora cinerea	21.7
lycii	27.8 e.g. *Populus* twigs
Perenniporia fraxinea	21.7 on base of *Platanus* K
Phanerochaete magnoliae	4.8 = *Peniophora eichleriana*, on chipboard K
Phellinus ferruginosus	20.8 cherry K
Phlebia livida	28.11 K
Phlebia radiata	1963 as *Ph. merismoides*
Polyporus squamosus	PCM
Radulomyces confluens	1963+ as *Corticium* c.
Ramaria abietina	20.10 K
stricta	9.9 massive specimens on mulched soil K
sp.?	17.11 untraced, spores small and smooth

Schizopora paradoxa	10.11
Sistotrema brinkmannii	1963+ as *Trechispora b.*
oblongispora	15.8 *Quercus* twig K
Skeletocutis nivea	PCH det. AH
Stereum hirsutum	1963+
rameale	7.7 K
rugosum	6.10
Tomentella ellisii	15.8 K
punicea	21.7 K
sublilacina	28.11
Tomentellastrum cf. *caesiocinereum*	9.9 small fragment on soil
Trametes gibbosa	PCH+ as *Pseudotrametes g.*
versicolor	1963+ as *Coriolus v.*
Trechispora cf. *dimitica*	2010 litter near remains of elm stump K

'HETEROBASIDIOMYCETES' (jelly fungi)

Auricularia auricula-judae	BI+
mesenterica	PCH+
Dacrymyces stillatus	1963+ as *D. deliquescens*
Helicogloea lagerheimii	17.11 *Salix* stump det. P. J. Roberts K
Myxarium nucleatum	10.11

'GASTEROMYCETES' (Puffballs etc.)

Bovista plumbea	9.9
Calvatia gigantea	1963+
Cyarhus olla	DLH+ on mulched beds, IMI
Handkea excipuliformis	PCH = *Calvatia e.*
Lycoperdon perlatum	7.7
pyriforme	1963+
Scleroderma bovista	PCH+
Sphaerobolus stellatus	7.7
Vascellum pratense	20.10

UREDINALES (Rusts)

Malampsora cf. *epitea*	6.10 on *Salix* sp. seedling
euphorbiae	PCH+ on *E. peplus*
hypericorum	PCH+ on *Hypericum* sp.
larici-populina	6.10 on *Populus* cf. *balsamifera*
Phragmidium bulvosum	6.10 on *Rubus* sp. det. PCH
cf. *mucronatum*	20.8 on *Rosa gallica* (uredospores only)
violaceum	6.10 on *Rubus* sp.
Puccinia caricina	21.7 *v. ribesii-pendulae* on *Carex pendula*
Puccinia caricina	PCH *v. urticae-acutiformis* on *c. acutiformis?*
cnici	PCH+ on *Cirsium vulgare*
coronata v. holci	PCH
iridis	27.10 on *Iris foetidissima* K
lagenophorae	PCH+ on *Senecio vulgaris, Bellis perennis*
lapsanae	PCH+
malvacearum	PCH+
polygoni-amphibii	PCH
var. *convolvuli*	19.9 on *Fallopia convolvulus* K
pulverulenta	27.8 on *Epilobium montanum*
punctiformis	PCH on *Cirsium arvense*
Pucciiastrum epilobii	9.9 pn *Chamerion angustifolium*
Uromyces muscari	PCH originally as *U. scillarum*

USTILAGINALES (Smuts)

Tilletia holci	PCH+ on *Holcus mollis*
Ustilago striiformis	PCH on *Holcus mollis*

ASCOMYCOTA (Rusts)

Species found only in their anamorph state are here placed in [ ]. Details of these are listed under 2.5 below 'Imperfect Forms'.

DISCOMYCETES

Aleuria aurantia	PCH as *Peziza* a.
Ascobolus crenulatus	PCH corrected from *A. minutus*
roseopurpurascens	6.10 horse dung kept damp
Dactylospora sp.?	PCH 3.1.95 awaiting verdict from IMI
[*Diplocarpon rosae*]	as *Marssonina anamorph*
Geopora foliacea	PCH det. B. M. Spooner
Hamatocanthoscypha laricionis	28.11 fallen *Taxus* leaves K
Hymenoscyphus caudatus	17.11 *Ailanthus petioles*
herbarum	10.11 dead stems of *Origanum* sp.
Iodophanus carneus	PCH+
Mitrophora semilibera	1963 described as '*gigas* from'
Mollisia cinerea s.l.	PCH+
discolor	15.8 *Quercus* twig (= v. *longispora* s.auct.)
[*Monilinia fructigena*]	as *Monilia* anamorph
Orbilia delicatula	PCH = *O. xanthostigma* of 1985 checklist
inflatula	4.8 = *O. auricolor sensu* 1985 checklist
Peziza vesiculosa	15.8 conf. B. M. Spooner K
[*Phacidium multivalve*]	as *Phacidiostroma* anamorph
Polydesmia pruinosa	PCH
Rhytisma acerinum	27.10 *Acer pesudoplatanus* seedling
Sccobolus depauperatus	6.10 horse dung kept damp
Scutellinia subhirtella	6.10 soil by lake, det S. Lines
Trochila ilicina	DLH *Ilex* leaves, fallen
Verpa conica	1963

'PYRENOMYCETES'

[*Apiocrea chrysosperma*]	as *Sepedonium* anamorph
Apiognomonia errabunda	BI *Quercus* fallen leaves
veneta	as *A. errabunda*, now considered a distinct species. *Plantanus* fallen leaves
[*Apiospora montagnii*]	as *Arthrinium* anamorph
[*Botryosphaeria stevensii*]	as *Diplodia mutila* anamorph
Capronia parasitica	15.8 old stromata of *Diatrypella quercina* K
Cephalotheca sulfurea	6.10 PCH det. AH, old worked wood, rare, IMI, K
Ceratostomella rostrata	28.11 = *C. ampullasca*, *Sorbus* stump K
Cercophora caudata	17.11 indet, stump K
Coniochaeta velutina	17.11 *Salix* stump K
Cryptodiaporthe salicella	DLH
[*Daldinia concentrica*]	as *Nodulisporium* anamorph
Diaporthe pardalota	9.9 Chusan palm leaf stalk det. B. M. Spooner K
Diatrypella favacea	24.11 twig of *Betula papyrifera*
quercina	DLH+ IMI; plus its *Libertella* state (AH)

Didymella proximella	21.7 *Carex pendula* leaf K
sp.	20.8 Heracleum sp. stem K (unnamed at Kew)
Epichloe typhina	PCH *Dactylis glomerata*
Eutypa leioplaca	DLH dead *Fagus* branch IMI
Gibberella sp.	17.11 *Ailanthus petiole* (old, no longer fertile)
Hypomyces aurantius	21.7 + *Cladobotryyum* anamorph
Hypoxylon rubiginosum	17.11 *Salix* stump
Kernia nitida	6.10 horse dung kept damp, rare, K
Lasiosphaeria caudata	15.8 *Quercus* twig
ovina	4.8 *Platanus* stump
spermoides	PCH
Leptosphaeria purpurea	4.8 chipboard K
Leptospora rubella	4.8 chipboard
Lophiostoma angustilabrum	19.9 dead root, ?*Ulmus* K
Nectria aquifolii	1963 det. C. Booth
cinnabarina	1963+
Nemania serpens	28.11 = *Hypoxylon* s., *Sorbus* stump
Ophiostoma novi-ulmi	DLH Dutch Elm disease, symptoms noted
Pleospora infectoria	4.8 dead leaf stem of Chusan palm
Podaspora decipiens	6.10 horse dung kept damp
Preussia funiculata	21.7 chipboard K
Phaeosphaeria herpotrichioides	21.7 *Carex pendula* leaf
Schizothecium fimicola	6.10 = *S. conicum*, horse dung kept damp
Stomiopeltis juniperi	15.8 dead leaves of *Juniperus* sp.
Trichothyrina norfolciana	21.7 cf. this (immature) on *Carex pendula* leaf
Tubeufia cerea	4.8 fallen twig (*Ilex*?)
[*Valsa nivea*]	as *Cytospora* anamorph
Xylaria carpophila	15.8 old *Fagus* cupules
hypoxylon	PCH+
polymorpha	1963, PCH
Zopffiella erostrata	6.10 horse dung kept damp

ERYSIPHALES (Powdery mildew)

(a * against a host denotes ascocarps seen on that host)
(a ! denotes a suspected first British record on this host)

Blumeria graminis	15.8 *Dactylis glomerata*
Erysiphe artemisiae	9.9 *A. vulgaris*
aquilegiae v. ranunculi	15.8 *Ranunc. acris**, *Cimicifuga rubrifolia**! K
biocellata	PCH+ *Lycopus europaeus*
cichoracearum	PCH+ *Achillea cultivar, Bellis perennis, Cirsium vulgare**, *Dahlia* 'Bishop of Llandaff', *Hieracium trichocaulson, Sonchus arvensis, S. oleraceus**
v. fischeri	20.8 *Senecio vulgaris*
convolvuli	9.9 *Calystegia sepium**
cruciferarum	21.7 *Lunaria rediviva, Sisymbrium officinale*
echinopsis	20.8 *Echinops ritro* 'alba'
galeopsidis	15.8 *Lamium album, L. purpureum, Monarda cultivar, M. sagittarius*
galii	6.10 *Galium odoratum* (planted)
heraclei	PCH+ e.g. *Aethusa cynapium, Heracleum* sp.*! (the unnamed 'palace' hogweed), *Cheirophyllum aureum**! K
knautiae	20.8 *Knautia cultivar, K. macedonica*
magnicellulata	27.8 *Phlox cultivars*
orontii	6.10 *Acanthus spinosus**! K
pisi	20.8 *Medicago lupulina, Vicia cracca*

polygoni	4.8 *Persicaria maculosa, Polygonum aviculare**. *Rumex acetosella*
sordida	4.8 *Plantago major*
urticae	15.8 *U. dioica*
Microsphaera alphitoides	PCH+ *Quercus*
berberidos	7.7 *Mahonia aquifolium, Berberis* sp.
euonymi-japonici	BI *E. japonicus*
lonicerae	19.9 *L. inflexa* in a pot
penicillata	24.11 *Alnus* sp.* K
platani	BI *Platanus* × *hispanica**
pseudacaciae	15.8 *Robiinia* sucker shoots K
syringae	9.9 *Syringa hyacinthiflora* culitvars
trifolii	20.8 *Lotus corniculatus, Trifolium pratense*
Oidium ericinum	20.8 *Rhododendron* (Azalea) cultivars
Podosphaera clandestina	15.8 *Crataegus* seedlings
Sawadaia bicornis	20.8 = *Uncinula* b., *Acer* pseud. seedlings
Sphaerotheca epilobii	27.8 *E. montanum*
euphorbiae	20.8 *E. amygdaloides 'rubra'*
fungax	20.8 Geranium cultivar 'Mrs Clark', *G. dissectum, G. molle*
fuliginea	27.8 *Veronica longifolia* cultivar
fusca	15.8 *Lapsana communis, Taraxacum officinale* sl.
pannosa	20.8 *Rosa* spp.
Uncinula adunca	20.8 *Populus canescens**
necator	19.9 *Vitis* sp.*

IMPERFECT FORMS (Coelomycetes and Hyphomycetes)

In general species with a known perfect state are listed here rather than under that state when only the conidial state has been recorded in the garden. But an exception is made for Powdery Mildews, which are all listed at 2.3 above, whether there were ascocarps present or not.

Alternaria alternata	15.8 *Alnus incana* 'cone'
infectoria	DLH *Onopordon* stems with *Iodophanus carneus* (coll. PCH, Det. IMI)
tenuissima	DLH dead *Heracleum* stems
Ampelomyces quisqualis	20.8 on mildew *Erysiphe knautiae* K (and on many other mildew species since)
Arthrinium state of *Apiospora montagnei*	DLH dead grass stem
Arthrobotrys oligosporum	6.10 horse dung kept damp
Bactrodesmium obovatum	19.9 dead exposed *Ulmus*? root K
Beauveria bassiana	4.8 *Opiliones* (harvestmen) K
Botrytis cinerea	1963+ various hosts
tulipae	1963 Tulip Fire Fungus
Camposporium antennatum	15.8 *Fagus* cupules K
pellucidum	15.8 *Fagus* cupules
Ceuthospora euonymi	1963
phacidioides	BI+ *Ilex* leaves = imperf. state of *Phacidium multivalve*
Chalara cylindrosperma	17.11 *Ailanthus petiole* K
Cladosporium herbarum	DLH e.g. fallen *Platanus* leaves IMI
Clonostachys compactiuscula	28.11 *Fagus* cupules
Colletotrichum dematium	DLH dead *Heracleum* stems
Costantinella micheneri	24.11 soil near *Prunus* K
terrestris	10.11 *Ulmus*, rotten wood K
Cytospora nivea state of *Valsa (Leucostoma) nivea*	208 bark of fallen *Populus* twigs K

Cytospora salicis	27.8 fallen *Salix* twigs K
Dactylaria purpurella	4.8 *Platanus* stump
Dendryphion comosum	24.11 *Urtica* stem
Dictyochaeta fertilis	15.8 = *Codinaea* f., *Fagus* cupules
simplex	15.8 = *Codinaea* s., *Fagus* cupules
Dictyosporium toruloides	15.8 *Fagus* cupules
Dinemasporium cf. *cytosporoides*	15.8 *Quercus* twigs K
graminum	4.8 dead stem of Chusan palm leaf K
Diplodia mutila state of *Botryosphaeria stevensii*	DLH *Fraxinus* twigs
Discosia artocreas	15.8 *Alnus incana* cones, *Quercus* cupules (both after keeping damp)
Doratomyces nanus	1963 det. M. B. Ellis
stemonitis	28.11 *Fagus* cupules
Endophragmiella taxi	28.11 fallen leaves of *Taxus baccata*
Fusariella hughesii	9.9 dead *umbellifer* stem + *Ailanthus petiole*
Fusidium aeruginosum	10.11 *Quercus* leaves
Helicosporium lumbricoides	15.8 Fagus cupule kept damp
[*Libertella quercina*]	15.8 state of *Diatrypella quercina* q.v.
Macrophoma ulmi	1963 det. B. C. Sutton, then new to Britain
Marssonia state of *Diplocarpon rosae*	DLH leaves of *Rosa* 'Freedom'
Menispora ciliata	28.11 *Sorbus* stump
Monilia fructigena state of *Monilinia* f.	20.8 rotten fallen apples
Monodictys castaneae	DLH fallen *Tilia* leaf
Nodulisporium sp.	PCH anamorph of *Daldinia concentrica*
Oedocephalum pallidum	6.10 horse dung kept damp
Paecilomyces farinosus	PCH as *Isaria* f.
Periconia byssoides	DLH *Urtica* stems
minutissima	15.8 *Fagus* cupule kept damp
Phoma complanata	27.8 *Anthriscus sylvestris*?, dead stem
herbarum	DLH *Urtica* stems
Phomopsis controversa	DLH *Fraxinus* twig
oblonga	1963 det. B. C. Sutton
Pithomyces chartarum	24.11 *Urtica* stem, uncommon in Britain, K
Pleurotheciopsis bramleyi	15.8 *Alnus incana* cone kept damp K
Pseudozythia pusilla	1963 det. B. C. Sutton, then new to Britain
Pycnostysanus azaleae	15.8 'bud blast' on *Rhododendron* spp.
Sepedonium chrysospermum state of *Apiocrea chrys.*	PCH+ *Paxillus involv.*, *Xerocomus chrysenteron*
Sphaeronema cf. *aemulans*	15.8 *Quercus* cupules kept damp K (det. E. Pumithalingam)
Stachybotrys atra	PCH+ chipboard, det. A.H.
Torula herbarum	DLH, PCH+ e.g. *Urtica* stems
Trichocladium opacum	1963 det. M. B. Ellis
Trichoderma viride	1963+
Trichothecium roseum	9.9 indet. rotting woody herbaceous stem
Tricladium castaneicola	27.8 *Fagus* cupules kept damp
Trimmatostroma betulinum	DLH dead *Salix* twigs
Triposporium elegans	DLH *Sorbus* stump
Verticillium rexianum	17.11 on myxomycete *Arcyria denudata*
Volutella ciliata	28.11 *Fagus* cupules

ZYGOMYCOTA

Rhopalomyces elegans	PCH
Syzygites megalocarpa	20.10 on old *Calvatia gigantea* fr. body K

OOMYCOTA (Kingdom Chromista p.p.)

Albugo candida	PCH 'White Blsiter' of Cruciferae
Albugo tragopogonis	BI on *Senecio vulgaris*

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Initial discussions between Buckingham Palace, the London Natural History Society and The Natural History Museum identified the need for some form of coordinating body to oversee the project. Accordingly, a steering group of "Core Recorders" was established. Meeting on a regular, though relatively infrequent basis within the Palace, this group was responsible for ensuring that the taxonomic coverage of the survey was as complete as possible and for finding appropriate personnel to undertake the field surveys, the identification of material and the writing up of results. This Core Recorders committee comprised Peter Barnard, Colin Bowlt (Chair), David Carter, David Hawksworth, Alick Henrici, Peter Holland, Mark Lane (Buckingham Palace), David McClintock, Edward Milner, myself, Roy Sanderson, Mary Spencer-Jones and Elinor Wiltshire. LNHS Secretary Tony Barrett and Quekett Microscopical Club representative Bryan Tabor both attended by invitation.

The authors of the papers are clear from the first page of each; their important contributions are acknowledged, though there is little point in repeating their names here. What are not so clear are the names of the other naturalists who also played a significant role, either in fieldwork at the Garden or as identifiers of material. Francis Rose made a number of comments in relation to the 1960s Bryophyte survey data. Ken Adams, Len Ellis and Alan Harrington assisted with determinations of Bryophytes. Amongst the botanists, Susyn Andrews successfully identified *Syringa* × *hyacinthiflora* 'Plena' (see page 47) whilst David Allen, Jane Browning, John Burnett, Rodney Burton, Lois Childs, John Bailey, Eric Clement, Tom Cope, Andrew Dudman, Gordon Graham, Ray Harley, Geoffrey Kitchener, Alison Paul, John Richards, Roy Vickery and Max Walters assisted with the higher plants. It is possible that the names of some botanical helpers remain obscure following the death of David McClintock; we hope that these people will forgive the absence of their names under the exceptional circumstances, and rest assured that their contributions are fully appreciated.

Dr Hilary Belcher was responsible for the identification of phytoplankton. Peter Holland was responsible for a great many fungus identifications. Dr F. Rose commented on the list of lichens in the earlier survey; Dr D. Job provided air pollution measurements from the Garden; Dr A. E. Heathfield gave advice of sulphur dioxide measurement conversion rates.

For help with the non-insect invertebrate section, thanks go to Stella M. Davies, who identified the slug *Lehmannia valentiana*, to Peter Merrett, David Nellist and Peter Harvey, who assisted with spider determinations, to Cliff Brooks, who assisted in the earthworm survey, Professor Roberto Bertolani, who confirmed the identification of some tardigrades, to Dr Geoffrey Fryer, who contributed comments and advice on the anomopodan Crustacea and to Peter Lawrence, Eric Goto, Henning Petersen, Arne Fjellberg and Steve Hopkin, all of whom contributed advice on the taxonomy of the Collembola.

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As far as the vertebrates are concerned, Dr Peter Kirk assisted with the field recording of fishes, and mammal field survey was carried out by Charlotte Aybes. Tom Langton commented on the paper concerned with amphibians and reptiles and Ken Osborne on the bird paper.

Each paper was peer-reviewed by two referees; these people, traditionally, have the right to remain anonymous.

On the Buckingham Palace side, Mark Lane, Head Gardener, sought and obtained enthusiastic permission for the survey from Her Majesty The Queen and has played a pivotal role in the day-to-day organisation of the survey. In particular, he managed irregular visits of field naturalists, all of whom required security clearance and most of whom required an escort whilst at the Palace. It is fair to say that without Mark's input very little would have been achieved and I am personally delighted that a species of insect new to science, discovered in the Garden during the survey, has been named in his honour (*Megaselia marklanei*, see pages 254–255). Other garden staff also deserve a mention for their interest and cooperation.

Mention should also be made of the officers of the Metropolitan Police, based at the Palace — always friendly and courteous, whilst still rigorously carrying out their important security duties. Finally, as far as Palace staff are concerned, it is also appropriate to mention Sir Michael Peat (Keeper of the Privy Purse), David Tuck (former Assistant Press Secretary) and Penny Russel-Smith (the current Press Secretary), all of whom had some input to this final report.

I would also like to conclude by adding a personal thank you to *London Naturalist* editor Keith Hyatt, who most kindly "re-edited" most of my carefully edited proofs and uncovered all those small errors and inconsistencies that only a good friend would have the nerve to point out!

Colin W. Plant
December 2001

Taxonomic index to contents

Numbers in bold relate to the two parts of the publication and are separated from the first page of the relevant text by a colon.

Introductory matters

Introduction to the survey **1**: 1
Geology, history and layout **1**: 5

The flora

Myxomycetes **1**: 9
Lichen-forming fungi **1**: 15
Non-lichenised fungi **2**: 315
Bryophytes **1**: 23
Wild and naturalised vascular plants **1**: 27
Garden plants **1**: 45

The vertebrate fauna

Fishes **1**: 49
Amphibians and reptiles **1**: 59
Birds **1**: 61
Mammals **1**: 77

Invertebrates other than insects

Mollusca **1**: 81
Arachnida **1**: 87
Oligochactae (earthworms) **2**: 109
Tardigrada **2**: 111
Rotifers and anomopodan Crustacea **2**: 115
Crustacea: Isopoda **2**: 303
Myriapoda **2**: 125

Insect groups

Apterygota

Thysanura **2**: 303
Diplura .... no records
Protura .... no records
Collembola **1**: 103

Exopterygota

Ephemeroptera **2**: 303
Odonata **2**: 303
Plecoptera .... no records
Orthoptera **2**: 303
Dermaptera **2**: 303
Dictyoptera **2**: 303
Psocoptera **2**: 303
Mallophaga .... no records
Anoplura .... no records
Hemiptera: Heteroptera and Auchenorhyncha **2**: 129

Hemiptera: Psylloidea, Aleyrodoidea and Coccoidea 2: 149
Hemiptera: Aphidoidea 2: 153
Thysanoptera 2: 303

Endopterygota

Neuropteroidea and Mecoptera 2: 159
Lepidoptera 2: 169
Trichoptera 2: 193
Diptera: Nematocera 2: 197
    Bolitophilidae, Keroplatidae and Mycetophilidae 2: 207
    Chironomidae 2: 213
Diptera: Brachycera 2: 219
    Phoridae 2: 245
    Syrphidae 2: 259
Siphonaptera ....no records
Hymenoptera: Parasitica 2: 303
Hymenoptera: Aculeata 2: 269
Hymenoptera: Symphyta 2: 281
Coleoptera 2: 283
Strepsiptera ....no records

The natural history of Buckingham Palace Garden, London. Part 2

Supplement to *The London Naturalist* No. 80

Contents

BATER, J. — The earthworms (Oligochaetae) of Buckingham Palace Garden 109

GREAVES, P. M. — The tardigrade fauna of Buckingham Palace Garden 111

HOLLOWDAY, E. D. — Rotifera and Anomopodan Crustacea in Buckingham Palace Garden Lake 115

LANGTON, P. H. — Centipedes and millipedes (Myriapoda) in Buckingham Palace Garden 125

KIRBY, P. — Bugs (Hemiptera: Heteroptera and Auchenorhyncha) in Buckingham Palace Garden 129

HALSTEAD, A. — The psyllids, whiteflies, scales and mealybugs (Hemiptera: Homoptera) of Buckingham Palace Garden 149

EASTOP, V. — The aphids (Hemiptera: Homoptera) of Buckingham Palace Garden . 153

PLANT, C. W. — Lacewings (Neuroptera), snakeflies (Raphidioptera), alderflies (Megaloptera) and scorpion flies (Mecoptera) in Buckingham Palace Garden . . . 159

CARTER, D. J. — The Butterflies and Moths (Lepidoptera) of Buckingham Palace Garden 169

BARNARD, P. C. — The caddisflies (Trichoptera) of Buckingham Palace Garden . 193

CHANDLER, P. J. — Nematocera (Diptera) in Buckingham Palace Garden 197

CHANDLER, P. J. — Fungus Gnats (Diptera: Bolitophilidae, Keroplatidae and Mycetophilidae) in Buckingham Palace Garden 207

LANGTON, P. H. — Non-biting midges (Diptera: Chironomidae) in Buckingham Palace Garden 213

SMITH, D. A. — Brachycera (Diptera) in Buckingham Palace Garden 219

DISNEY, R. H. L. — The scuttle flies (Diptera: Phoridae) of Buckingham Palace Garden 245

PLANT, C. W. — Hoverflies (Diptera: Syrphidae) in Buckingham Palace Garden . . 259

HARVEY, P. R. — The bees, wasps and ants (Hymenoptera: Aculeata) of Buckingham Palace Garden 269

PLANT, C. W. — Smaller invertebrate orders in Buckingham Palace Garden 303

HENRICI, A. — Non-lichenised fungi in Buckingham Palace Garden 309

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